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Fig. 1.—Brick Tunnel Showing Conduit in Course of Being Laid.

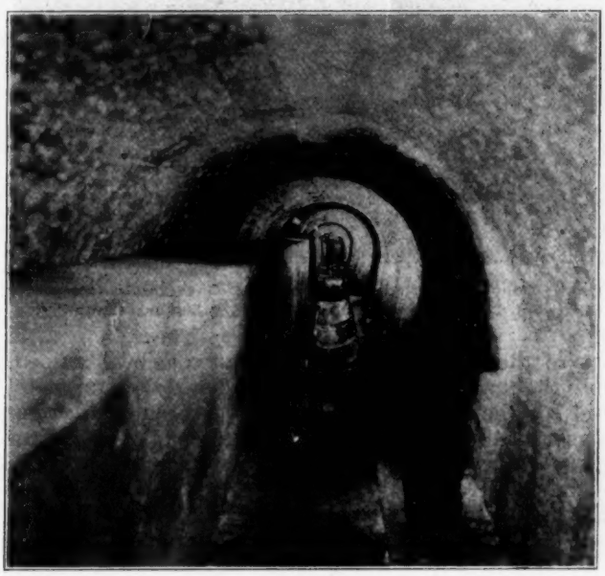

Fig. 2.—Duct Line Laid and Cemented in Tunnel of Concrete.

Conduit Construction in Telephone Cable Tunnels

Interesting Features of Latest Tunnels Adopted by the Chicago Telephone Co.—Construction Methods Employed

CHICAGO is traversed by the Chicago river, which follows a winding course through the city. The electric power and telephone utilities have found that the use of submarine cable where the river has to be crossed is unsatisfactory in the ordinary way because of the great likelihood of these cables being torn up, with resultant service interruptions and high cost of maintenance. The result is that both the telephone and light and power companies have resorted to the use of tunnels for their trunk cables or cable routes, as being a sound solution to the problem and one that guarantees safety to service and eventual economy of investment.

In the ELECTRICAL REVIEW of June 21 appeared an article by G. B. Springer on the construction of tunnels by the Commonwealth Edison Co. This article dealt with the reasons why tunnels have been adopted in preference to any other method, financial gains and structural details.

The Chicago Telephone Co. also has constructed several tunnels for its 300, 600 and 900-pair cables where the Chicago river has to be crossed. While the problems encountered by the telephone company were similar and almost identical to those that represented themselves to the power company, described in the issue of June 21, certain features of the tunnels for the telephone cables are different to those already described and a number of interesting features are brought out here.

The average length of the tunnels is about 700 ft. and their depth beneath the level of the sidewalk varies from about 80 to 90 ft. Some of the older tunnels are constructed of brick, but all the later ones are built entirely of concrete. The wall of these is 9 in. minimum thickness, about 6.5 ft. in height and 6 ft. in width. Allowing for the space occupied on both sides of the tunnel by ducts, a space of about 3 ft. 6 in. is available between ducts for persons to walk through the tunnel. The tunnel bottom is finished smooth with a grade one way to afford natural drainage. At the end of the tunnel having the lower level a sump pit is built. In this way it is an easy matter to empty a flooded tunnel of water by merely lowering a pump down the shaft to the sump pit.

The material was handled by lowering the ducts in a box made for the purpose. The box was supported by ropes fastened to each corner with a safety sling to a hook on the end of a three-quarter-inch line operated through a snatch block rigged to a derrick at the

Fig. 3.—Conduit Stacked Ready for Use. Cheesecloth Is Used to Prevent Ducts From Being Clogged Up During Assembly.

top of the shaft. Sand, gravel and cement were sent into the tunnel by means of a wooden chute and material for the use of the construction through the river was mixed on the floor of the tunnel, opposite the point required. The concrete for the tunnels were mixed by hand in the tunnels. The concrete for the lining of the shafts was mixed above ground.

Details of Shafts.

The shafts leading to the tunnels are circular and all are built of concrete, the thickness being 13 in. minimum. The method employed for building these shafts depended upon the nature of the ground passed through, which was at different times quicksand, rock, clay, etc. All shafts are 6½ ft. inside diameter.

A galvanized iron step ladder was built into the shaft as it was lined with concrete, as also were 3-in. angle irons placed every 3 to 4 ft. on opposite sides of the shaft to serve as supports for the vertical duct lines. The distance between these angle irons is about 2½ ft., being therefore amply sufficient to permit a man to pass down the shaft into the tunnel. As the tunnels have been built with sufficient capacity to care for future growth, only the vertical ducts or risers on one side of the shafts have been installed to date. The opposite, or empty, side is covered at the top by a safety grating of cast iron which prevents persons falling down the shaft through the space that will eventually be occupied by conduit.

Fig. 4.—Four-part Duct as Used in Horizontal Duct Line After Single Duct Emerges From Riser From Tunnel.

Conduit Construction.

The floors of the tunnels were leveled in order to provide a straight foundation and treated with a cement mortar for the first layer pipe, which was constructed with the use of a wooden mandrel with all joints in the different rows staggered and each joint wrapped with cheese cloth to prevent any foreign substance from entering the pipe. The bottom row was laid for about 100 ft. with the next rows in rotation,

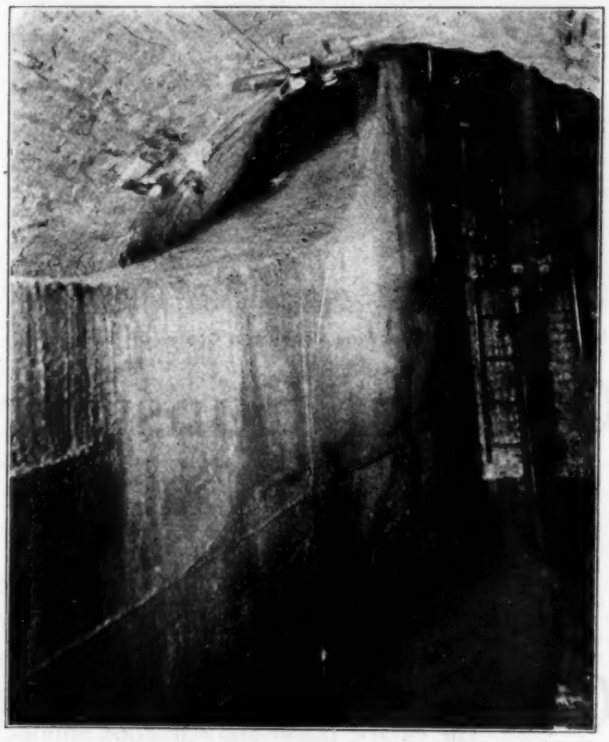

Fig. 5.—Duct Line Where Horizontal Run Changes to Vertical. View Taken of Lower Tunnel Level, Showing Collection of Drainage and Emerson Pump.

until all rows were installed, when the concrete form was built and concrete placed. The conduit is covered with a 3-in. covering of cement. After the completion of the conduit through the bore of the tunnel each pipe was rodded, swabbed and fish wire installed.

The work of building the foundations for the radius curves was next in line. This involved considerable care to provide the proper radius for the bends, which were installed with the straight pipe and a perfect radius provided. The shortest radius adopted was 10 ft. 6 in., and the largest about 14 ft. 6 in.

The construction of the riser pipes in the shafts necessitated extreme care and in order to prevent any substances from dripping on the pipes, they were plugged after each section was placed. As this work progressed, the first wire was drawn through until the job was completed, when these wires were replaced with No. 9 galvanized iron wire, after a thorough

swabbing, and all ducts provided with wooden conduit plugs.

For the vertical sections or risers, the ducts are placed in position by a mandrel, which consists of a wooden rod 12 ft. in length upon which the sections of duct were threaded or strung. This assured perfect alinement of the ducts and reduced the time of building the vertical sections. Three-inch angle irons are built into the shaft every 3 to 4 ft., and to these the wooden forms are fastened after which the concrete of a mixture of one part cement, three parts gravel and five sand, is poured. Wooden forms were used for filling in and covering in the ducts. Wooden forms were, in fact, used throughout the job.

The ducts are laid three wide and 8 to 10 ft. high. The ducts are of vitrified clay with an inside diameter of about 4 in. The company in the past and for usual underground work has employed the multiple duct. However, for the work such as tunnels it has been found that the single duct is far more preferable. With multiple duct it would have been practically impossible to make the curves required at the vertical or risers with the multiple duct and castings would have had to be employed at these sections.

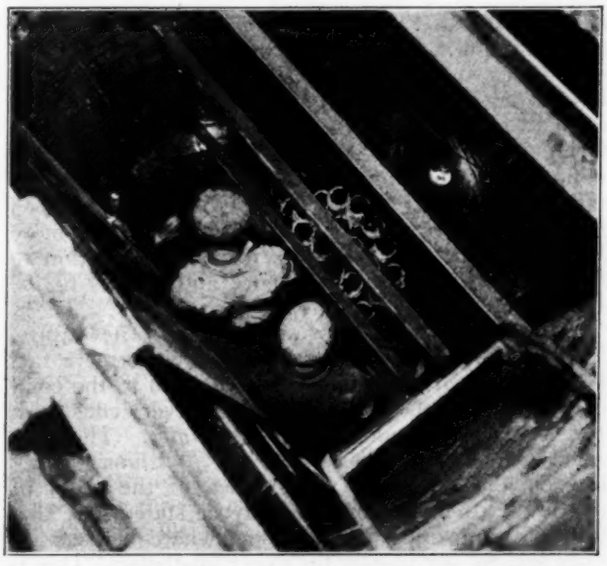

Fig. 6.—View Looking Down Brick Lined Shaft Showing Location of Ducts Ladder and Angle Irons.

Moreover, with multiple duct only six 4-duct elements could be used, holding 24 cables, whereas by employing single duct 30 cables can be carried on one side of the tunnel.

The decision of the company to use vitrified clay duct instead of iron pipe, as had been used previously in the company's former tunnels, was that iron pipe has been found quite objectionable in many ways. To begin with, iron pipe subjected to such conditions as exist in tunnels, where corrosive liquids and gases are ever present, corrode rapidly. Corrosion of the pipe occurs and also electrolytic action between the iron pipe and the lead cable sheath. Rust from the upper surfaces of the interior of the pipes falls down to the bottom, causing clogging of the pipe, which introduces difficulties when the time comes to pull out the old and pull in the new cable. At the risers it has been found that the rust from the vertical portions of the risers falls and collects at the bottom of the vertical, here also causing collection, rusting together and trouble.

WAR DEPARTMENT ANNOUNCES SALE OF CARTRIDGE CASES.

Rejected Cases Are Especially Suitable for Lamp Shades or Bases.

The Director of Sales of the War Department has announced a sale, at 20% above the current market price of their metal content, of 1,500,000 brass cartridge cases not suitable for military purposes. These cases are especially adapted for souvenir and novelty purposes and can be easily converted into lamp shades, lamp bases and similar artcraft articles.

The offering includes artillery cases of the following sizes: 75 mm., weight 2.61 lbs.; 4.7 in., weight 8.25 lb.; 6 in., weight 7.03 lb.; 3 in., anti-aircraft, weight, 6.75 lb. The metal content of the cases is approximately 70% copper and 30% spelter.

The 75-mm. cases are located at Providence, R. I., Breckenridge, Pa., Mays Landing, N. J., and South Amboy, N. J. The 4.7-in. cases are located at Burneage, Mass., Waterbury, Conn., and South Amboy, N. J. Prospective purchasers are requested to communicate with the Ordnance Salvage Board, 6th and B streets, Washington, D. C., or the Salvage division, Purchase, Storage and Traffic Division, Munitions building, Washington, D. C., or the Surplus Property Officer, Zone Supply Office, in any of the larger cities.

TELEPHONE FACILITIES IN NEW YORK TO BE IMPROVED.

Important Construction Work Now Under Way to Improve Service.

In connection with hearings being held by Public Service Commission as to the adequacy of the telephone service given by the New York Telephone Co., F. H. Bethell, vice-president of the company, in a recent letter addressed to the Commission, sets forth that the service has been seriously disorganized by war conditions, and that at the present time there should be in the New York City plant no less than $25,000,000 in additional construction to properly handle the city's traffic. It is pointed out that important new construction is already under way, including a new central office building in the Bronx, two in Brooklyn, and the installation of complete new switchboard units in four Manhattan central stations and one station in Queens. Also plans have been arranged for extensive additions to existing switchboard equipment for five Manhattan, six Brooklyn, one Queens, and one Bronx central station.

TRADE EXPERT TO VISIT LESSER ANTILLES AND HAITI.

C. Grand Pierre, West Indian trade expert of F. C. Luthi & Co., 277 Broadway, New York City, left recently for the Lesser Antilles and Haiti. One of the purposes of his trip is to continue negotiations for the organization of public utilities, including electric lighting plants, a telephone system, etc., in these places.

The company has unusually strong personal connections with the prominent people of these islands and Mr. Pierre will look into the advisability of negotiating for quite a number of public utilities which the company has in view as possibilities. The company is also preparing for some work in South America where it maintains its own offices.

Central-Station Rates in Theory and Practice

Seventh Article—The Consumer Cost, What It Includes and How It Varies—Determining the Numerical Values of the Three Elements of Cost—Analytical Valuation of Costs

By H. E. EISENMENGER

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This is the seventh article of this series, which began in the issue of July 12 after a general outline in the issue of July 5. The present article concludes a discussion of the cost of central-station service, which has included detailed consideration of the three principal elements of the cost—energy, demand and consumer cost, the latter being treated in this present installment. In the next article will begin Part II of this series—The Price of Electric Service—Rates. The preceding articles have thus served as an important preliminary to the main body of the text, which will be continued weekly throughout practically the remainder of this volume.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II-A. The Three Elements of Cost.

3. The Consumer Cost.

A. CAPITAL CHARGES.

SECTION 54. There is a certain amount of money to be invested by the electric light and power company for every consumer individually over and above the capital which is invested for the consumers collectively in the central station and in the distribution lines. A large part of this additional investment is occasioned by the bare fact that the consumer is connected to the lines and this part has practically nothing to do with the amount of electrical energy consumed by the customer or with his maximum demand. It amounts to the same for a large consumer and for a small one. To make this clear, consider the following: It is general central-station practice that most equipment up to and including the consumer's meter is paid for by the electric light company, whereas the interior wiring proper, beginning behind the meter, is paid for by somebody else, usually the house-owner or the consumer. There is, therefore, a certain capital invested by the company for every single consumer individually. This consists in the cost of the so-called service wires or drop wires, that is, the connection from the street lines to the building and into the main service cutout; moreover, it includes the cost of the meter, etc. Up to a certain size of consumer this investment will be practically constant per consumer and above that size we can regard it as composed of two parts: A constant part (cost of average length of service connection, if constructed with minimum size of poles and minimum thickness of service wires; also cost of minimum size of meter, etc.) and another part proportional to the maximum demand of the consumer. Apportioning the capital charges of this latter part to the demand cost, we see that we have a certain investment left which is independent of the size of the consumer and therefore we will also have certain annual charges which are independent of the size of the consumer.

B. OPERATING EXPENSES.

55. Moreover, there are direct annual expenses, apart from the expenses caused by the capital investment, which also amount to substantially the same sum per customer, whether he be a large or a small one. Thus the electric light company generally has to send out a meter reader every month to every customer to read the amount of kilowatt-hours consumed during that month and then the company's clerks have to figure out the amount of his bill. They have to write out the bill, send it out to the customer, keep their records whether and when he has paid and more such clerical and bookkeeping work. In addition to this are the costs of maintenance and repairs to the service lines and meters, etc.

56. All these expenses, including the capital expenses for meter, etc., are caused by the mere fact that the respective consumer is connected to the company's lines and they are the same for every consumer, that is, they are *constant per consumer.* They are called the *"consumer cost"* or the *"customer cost."* To give the beginner a rough idea of the order of magnitude of this amount, it may be stated here that different companies figure it somewhere between 50 cents and $1 per month for every customer. This is negligible in case of large consumers, who are paying a hundred or several hundred dollars per month. But it constitutes a very large percentage of the cost of serving the small consumer, whose monthly bill is perhaps somewhere between $1 and $5, or even lower.

C. INFLUENCE OF THE CONSUMER COST ON THE TOTAL COST PER KILOWATT-HOUR.

57. It has been mentioned before (Section 10) that it is frequent practice to reduce the total cost (and also the price) of serving a customer, to the unit of kilowatt-hours consumed by him, that is to say, the cost (or the price) of electricity is so much *per kilowatt-hour.* It is now clear that the total cost of serving the small consumer, per kilowatt-hour, is very much greater than that of serving the larger consumer in consequence of the fact that the consumer cost is constant per consumer. If the customer cost is, for instance, $1 per month per consumer, the cost per kilowatt-hour caused by a consumer who is using only 10 kw-hr. per month, *must* exceed 10 cents per kw-hr., since 10 cents per kw-hr. are necessary to cover the item of the customer cost alone. If the consumer is

using 10,000 kw-hr. per month, the customer cost per kw-hr. will be 0.01 cent, that is, practically negligible, and the cost per kilowatt-hour will be as low as other circumstances will permit.

D. VARIATIONS OF THE CONSUMER COST BETWEEN CONSUMERS.

58. Of course, the consumer cost per consumer although being approximately constant is not quite *strictly* constant, no more than the demand cost per kilowatt, or the energy cost per kilowatt-hour, are *strictly* constant.

If, for instance, a building is located far back from the street (where the distribution lines are run) the service lines from the street to the house will have to be longer and therefore more expensive than the average and perhaps we may even have to put up an extra pole or two for the service line. It has been shown before (Section 51) that the demand cost will be higher if the building is located in a thinly settled part of the town (which is particularly true in case of residences). Likewise, the customer cost in such districts will be higher because the meter readers, trouble men, etc., of the company will have to walk or ride so much longer from one customer to the next and therefore will not be able to cover as many customers in a day. This will apply particularly to residences in poorer districts where not every house is connected to the lines and also in some very fashionable quarters where every house is surrounded by a large garden. Furthermore, in case of residences, these employes of the electric light company will have to call twice or oftener in a certain percentage of the houses because they found the door locked and nobody at home on their first visit. This second visit is, of course, more expensive than the first one because the meterman may have to go quite a distance out of his way to reach the single house where he could not get access the day before. On the other hand, in case of "commercial customers" (this term means business enterprises) the meterman can be sure that he can get access to the premises and the meter at any time of the business day.

These differences between the customer cost of various customers are as a rule only small; an attempt to take all these small variations into consideration would generally hopelessly complicate matters and bring very little gain, just as in some cases of the variations of the energy cost and the demand cost, as already explained.

B. THE DETERMINATION OF THE NUMERICAL VALUES OF THE THREE ELEMENTS OF COST.

59. To determine for practical purposes the three items of energy cost, demand cost and customer cost, we can proceed as follows: We see from the company's books how large the expenses have been in a certain year under the various headings, for instance, for fuel, attendants' wages in the power house, salaries of the clerical forces, and dozens of other headings. We also know the value of the various parts of the plant, the life to be expected from them, etc., and consequently we can find the annual capital charges for those various parts. Now we distribute these various items of annual expenses by our best judgment under the three headings of energy cost, demand cost, and customer cost. For instance, 90% of the fuel cost may be assumed to go to energy cost and the remaining 10% to demand cost. The wages of the meter readers will go to customer expense and a certain percentage of the salaries of the clerical force goes to the same item. An intelligent scrutiny will generally give a pretty definite idea just how much of the time and the salaries has been devoted to the making out of the bills and similar work which goes to customer cost. Other expenses will be more or less in the air as far as that is concerned, for instance, the directors' salaries, advertising expenses, etc. It is plain that there is a certain element of arbitrariness in the whole procedure, but this element is smaller than would appear from this description. A large part of the cost can be assigned without much doubt to one or the other of the three items and only a moderate percentage remains questionable and has to be squeezed in somehow. After we have thus determined the total amount of each one of the three items of the cost, it is easy to divide them by the total energy consumption in kilowatt-hours, by the maximum demand in kilowatts and by the number of customers, respectively, to get the three unit costs. Corrections will then have to be made to allow for the diversity-factor, etc., as shown above.

60. As has been pointed out just now, there is in this method a certain element of uncertainty and arbitrariness about the apportionment of certain parts of the cost. We can remove this uncertainty in theory, and under certain conditions greatly reduce it in practice by a method which may be roughly characterized as taking into consideration the changes which the energy consumption, plant capacity (peak load) and number of consumers of the central station have undergone during the last few years and bringing them into connection with the simultaneous changes of the total yearly expenses. In this manner we arrive at the average values which the three headings of cost have had during the period under consideration.

This method, which implies the use of a little simple mathematics, was first proposed by the present author in 1914. An abbreviated reproduction of the original article in which this method was first put forth in this country by the author is contained in Insert VIII.

61. The preceding sections contain quite a lengthy theory of the cost of electric service and of the methods by which we can arrive at the figures for that cost. The author does not wish to convey the idea thereby that such scientific methods are generally employed by the central-station companies. Many of these companies, especially the smaller ones, are using to this day crude methods to learn what their unit costs are. We still frequently find the statement that the cost to the central station of service is so much per kilowatt-hour. This is a very convenient and intelligible statement, but—except in some special cases, where the governing conditions of service are known—it is not at all adequate. It will not be denied, however, that larger and well managed companies are employing much time and work on ascertaining their unit costs—time and work which are generally well and profitably spent.

Insert VIII—Appendix to Section 60.

NUMERICAL EVALUATION OF THE THREE ELEMENTS OF COST.

(Contains considerable mathematics in the proof, but the results contain only elementary algebra.)

This method was published by the author for the first time in English in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of Aug. 15, 1914, of which article the following is a portion (modified to tie in with the rest of this series).

1. Calling c_1 the unknown customer cost per customer per annum,
   c_2 the unknown energy cost per kw-hr. consumed,
   c_3 the unknown demand cost per kw. of peak

responsibility or rather of "equivalent demand" (see Insert VI).

d the peak responsibility or the equivalent demand, respectively, of a certain customer,

e the same customer's yearly energy consumption in kw-hr.,

k the (unknown) total cost of serving that customer per annum,

we get the following equation:

$$k = c_1 + c_2 e + c_3 d \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Adding these equations for all customers of the central station (considering the central station itself as a customer also, as far as its home consumption of electric service is concerned) we get

$$\Sigma(k) = c_1 N_1 + c_2 \Sigma(e) + c_3 \Sigma(d) \quad \ldots\ldots\ldots\ldots (2)$$

where N_1 is the total number of customers served in that year.

$\Sigma(k) = K_1 =$ total annual cost of the central station.

$\Sigma(e) = E_1 =$ total energy consumed annually in kw-hr.

$\Sigma(d) = D_1 =$ sum of the customers' peak responsibilities (which is equal to the sum of the customers' equivalent demands, see Insert VI, and to the central station's peak load, neglecting, in the latter case, the losses in transmission, transformation and distribution).

We have thus

$$\left.\begin{aligned} K_1 &= c_1 N_1 + c_2 E_1 + c_3 D_1 \\ \text{for the following year we find} \\ K_2 &= c_1 N_2 + c_2 E_2 + c_3 D_2 \\ \text{and for the third year} \\ K_3 &= c_1 N_3 + c_2 E_3 + c_3 D_3 \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

In these equations the values of K, N, E and D are known and we have, therefore, three linear equations for determining the three unknowns, c_1, c_2 and c_3. On account of the small number of the unknowns, any elementary method, such as the method of substitution or elimination, could be employed for solving the equations.

2. The following investigation will show, however, that the equations (3) can generally not be employed without further changes. The results of this investigation are expressed in simple algebra and readers who do not care to follow the author into the details of the investigation will find the simple results summarized in Section 4 *et seq.* of this Insert.

These investigations are carried out here with the help of the theory to determinants. Readers who are not familiar with determinants are referred to the author's article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of Aug. 15, 1914, where the same investigation is also carried out graphically with the same results.

3. The values of the three knowns are given by

$$c_1 = R_1/R, \quad c_2 = R_2/R, \quad c_3 = R_3/R$$

where R, R_1, R_2 and R_3 are the following determinants:

$$R = \begin{vmatrix} N_1 E_1 D_1 \\ N_2 E_2 D_2 \\ N_3 E_3 D_3 \end{vmatrix} \qquad R_1 = \begin{vmatrix} K_1 E_1 D_1 \\ K_2 E_2 D_2 \\ K_3 E_3 D_3 \end{vmatrix} \qquad R_2 = \begin{vmatrix} N_1 K_1 D_1 \\ N_2 K_2 D_2 \\ N_3 K_3 D_3 \end{vmatrix} \text{ etc.}$$

The theory of determinants shows that equations (3) cannot be solved by finite values if

$$N_1 : N_2 : N_3 : = E_1 : E_2 : E_3 : = D_1 : D_2 : D_3 : \quad \ldots\ldots\ldots\ldots (4)$$

because in that case determinant R becomes zero and the equations will be fulfilled either by $c_1 = 0/0$, $c_2 = 0/0$, $c_3 = 0/0$, or by $c_1 = \infty$, $c_2 = \infty$, and $c_3 = \infty$. In the first case the three equations are identical amongst one another, the problem is underdetermined, and in the second case the equations contradict each other.

The latter case (contradiction of the equations) cannot occur in practice if we take the correct figures, but the first case may take place. It is most improbable that equation (4) will be fulfilled accurately, that the number of customers will grow in exactly the same ratio as the energy consumption and the central station's peak load grows; this means in other words, it is highly improbable that the central station's load-factor E/D will remain absolutely constant and also the average energy per consumer E/N and the average peak responsibility per consumer D/N. But it may happen and it may even be expected to happen that the changes of these three ratios from one year to the next will be very small. This means that the values of the determinants R, R_1, R_2 and R_3 are small as compared to the values of the factors K, N, E and D of which the determinants are composed. The determinants consist of a number of positive and negative members, which will very nearly cancel if equation (4) is very nearly fulfilled; for instance, the determinant will be figured as $1857 - 1854 = 3$. A small percentage inaccuracy of one or more of the constituent members (for instance, 1860 instead of 1854) may, and generally will, result in a very large error of possibly several hundred per cent of the value of the determinant and may even result in negative values for c_1, c_2 and c_3.

Such inaccuracies are inevitable. For instance, the figures we get from the company's books for the annual cost are the amounts *paid* for materials, wages, etc., during the respective year, whereas they ought to be for this computation the cost of materials, etc., actually *used* during that period. That is not exactly the same. The company may have bought a certain amount of fuel, for instance, in one year and used not all of it in the same year, and, moreover, paid for it only in the following year. Or in a certain year a repair has occurred which is particularly expensive and is due to extraordinary circumstances or accidents, for instance a boiler explosion, etc.

4. The requirements of a sufficient variation of the load-factor, the energy consumption per consumer and the average demand per consumer are generally better fulfilled if, instead of three successive years, three months are chosen at different seasons since the load-factor in summer and winter, for instance, reaches entirely different values. The result is further freed from the influence of casual irregularities by choosing not, as assumed heretofore, only three such periods, but by extending the calculation over a large number of periods, such as 24 months, with the result that one obtains average values of a larger number of periods.

This results in 24 linear equations with three unknowns. There is, of course, in general no solution possible which satisfies all the 24 equations, but it is possible to find those values of the unknowns which satisfy the equations in the most accurate way, that is, with which the sum of the squares of the errors becomes a minimum, or in other words the most probable value. This is done by the method of Gauss which consists in the following:

Let the 24, or in general n, equations be (denoting the unknowns in the customary way as x, y and z):

$$\left.\begin{aligned} N_1 x + E_1 y + D_1 z &= K_1 \\ N_2 x + E_2 y + D_2 z &= K_2 \\ N_n x + E_n y + D_n z &= K_n \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots (5)$$

Multiply both sides of the first equation by N_1, those of the second equation by N_2, etc., and add the equations which are obtained thereby:

This results in a new equation:

$$\begin{aligned} &(N^2_1 + N^2_2 + \ldots + N^2_n)\, x + (E_1 N_1 + E_2 N_2 + \ldots + E_n N_n)\, y \\ &\quad + (D_1 N_1 + D_2 N_2 + \ldots + D_n N_n) z \\ &\quad = N_1 K_1 + N_2 K_2 + \ldots + N_n K_n \quad \ldots\ldots\ldots\ldots\ldots (I) \end{aligned}$$

This equation (1) is called the first normal equation. Now if we multiply the first one of equations (5) by E_1, the second one by E_2, ... etc., and add them again we obtain the second normal equation:

$$\begin{aligned} &(E_1 N_1 + E_2 N_2 + \ldots + E_n N_n)\, x + (E^2_1 + E^2_2 + \ldots + E^2_n)\, y \\ &\quad + (E_1 D_1 + E_2 D_2 \ldots + E_n D_n)\, z \\ &\quad = E_1 K_1 + E_2 K_2 + \ldots + E_n K_n \quad \ldots\ldots\ldots\ldots\ldots (II) \end{aligned}$$

In an analogous manner we get the third normal equation by multiplying all equations (5) by D_1, D_2 ... D_n, and adding them thus obtaining

$$\begin{aligned} &(D_1 N_1 + D_2 N_2 + \ldots + D_n N_n)\, x \\ &\quad + (E_1 D_1 + E_2 D_2 + \ldots + E_n D_n)\, y \\ &\quad + (D^2_1 + D^2_2 + \ldots + D^2_n)\, z \\ &\quad = D_1 K_1 + D_2 K_2 + \ldots + D_n K_n \quad \ldots\ldots\ldots\ldots\ldots (III) \end{aligned}$$

The three normal equations can be written in a shorter and more perspicuous way as follows:

$$\Sigma(N^2_m)\, x + \Sigma(E_m N_m)\, y + \Sigma(D_m N_m)\, z = \Sigma(N_m K_m) \ldots (I)$$

$$\Sigma(E_m N_m)\, x + \Sigma(E^2_m)\, y + \Sigma(E_m D_m)\, z = \Sigma(E_m K_m) \ldots (II)$$

$$\Sigma(D_m N_m)\, x + \Sigma(E_m D_m)\, y + \Sigma(D^2_m)\, z = \Sigma(D_m K_m) \ldots (III)$$

It is seen that the 9 co-efficients of the unknowns are partly identical with each other in couples according to a law of symmetry which can be easily recognized. This makes their computation easier.

These three normal equations solved for the three unknowns x, y and z yield directly the most probable values for the latter, that is, the values which approximate most closely the simultaneous fulfillment of all the n original equations.

5. The charges found in the foregoing manner require a correction.

The kilowatt-hour charge must be increased in the ratio of kilowatt-hours generated to kilowatt-hours sold, since only the kilowatt-hours sold are paid for and not, as has been assumed heretofore, the kilowatt-hours generated.

On the other hand, the demand charge must be reduced because in practice it is based not on the "equivalent demand" of the customer or on his peak responsibility but on his individual maximum demand. The customers are classified and the ratio $\frac{\text{equivalent demand}}{\text{maximum demand}}$ or $\frac{\text{peak responsibility}}{\text{maximum demand}}$ is then found by measurements or by estimating to our best

ability. The average of this value prevailing within every class of customers is then the reduction factor prevailing within that class.

6. The method described above is, of course, not restricted to the number of three charges as one can also aim from the beginning at the application of two charges only, for instance, a kilowatt-hour charge and a demand charge, and then one obtains only two unknown y and z (c_2 and c_3) in the equations. With such central stations which are also in the electric railroad operating business one could add two more unknowns to the three original ones, namely, u (that is, that part of the cost of railroad operation which is proportional to the number of car-miles) and v (that is, that part which is proportional to the length of track). It should be understood, however, that the calculation of five unknows out of about 24 equations is a rather lengthy operation even with the use of computing machines and it is probably preferable in all those cases to separate the railway cost from the beginning entirely from the rest of the cost, if possible. The expenses which are common to both branches, such as general expenses, must then be distributed arbitrarily to our best judgment between the two branches of the business. Each one of the two branches is then to be resolved into its parts according to the analytic method just shown.

7. As regards the length of the period over which the computation should be extended, it must not be too small so that accidents do not exert a disturbing influence and that a proper average can be found. On the other hand, it must not be too large since the amount of the cost for the different charges is slowly changing in the course of the years in consequence of the development of the central station (for instance, the use of more economical generators, etc.). Twenty-four monthly periods are about the proper figure under ordinary circumstances. If during that time a change of rates has occurred, this influences favorably the accuracy of the computation since thereby the character of the use of the current by the customers is changed. The load-factor or the average number of kilowatts or kilowatt-hours, or all of these factors, are liable to change and this, as shown above, makes possible a more exact computation of the unknowns.

(To be continued.)

POWER PRODUCTION AND FUEL CONSUMPTION BY UTILITIES FOR MARCH.

The following report is based on returns obtained by the Division of Power Resources, United States Geological Survey, from 3075 electric power plants engaged in public service, including central stations, electric railways and certain other plants, the output of which contributes to the public supply. The output for the month averages 101,400,000 kw-hr. per day, of which 41% was produced by water power. The average consumption of coal per kilowatt-hour of those plants using coal, was about 3 pounds.

THOUSANDS OF KILOWATT-HOURS PRODUCED.

State.	Waterpower.	Fuels.
Alabama	30,275	4,907
Arizona	6,689	21,807
Arkansas	72	6,620
California	215,914	33,939
Colorado	14,254	17,144
Connecticut	14,884	37,469
Delaware	.....	4,784
District of Columbia	.....	19,172
Florida	892	8,789
Georgia	37,264	6,082
Idaho	39,913	257
Illinois	15,282	207,705
Indiana	3,648	54,613
Iowa	48,502	25,051
Kansas	1,223	30,775
Kentucky	4	19,127
Louisiana	.....	14,866
Maine	20,157	73
Maryland	371	13,898
Massachusetts	31,365	100,034
Michigan	59,650	96,101
Minnesota	34,881	16,848
Mississippi	.....	5,399
Missouri	5,920	38,396
Montana	77,861	854
Nebraska	959	16,687
Nevada	2,450	121
New Hampshire	7,971	1,958
New Jersey	197	76,775
New Mexico	56	1,556
New York	222,318	288,191
North Carolina	46,333	7,426
North Dakota	.....	2,453
Ohio	3,932	194,850
Oklahoma	183	12,981
Oregon	29,014	3,779
Pennsylvania	62,509	246,989
Rhode Island	805	18,405
South Carolina	43,417	4,045
South Dakota	3,579	4,042
Tennessee	45,222	10,680
Texas	200	48,034
Utah	15,463	.....
Vermont	18,393	179
Virginia	20,221	18,774
Washington	79,347	4,521
West Virginia	1,593	58,108
Wisconsin	37,569	33,053
Wyoming	172	3,898
Total	1,300,924	1,842,214
Combined total		3,143,138

The production of the electric power reported required the combustion of fuels in the quantities indicated in the following table:

State.	Coal, short tons.	Petroleum and derivatives, bbl.	Natural gas, M. cu. ft.
Alabama	16,467	.....	.....
Arizona	6,160	88,011	.....
Arkansas	11,177	489	85,398
California	.....	185,127	181,785
Colorado	44,079	95	.....
Connecticut	62,234	323	[a]12,615
Delaware	7,713	17	.....
District of Columbia	20,483	.....	.....
Florida	5,594	199,149	151
Georgia	11,934	120	.....
Idaho	111	10	.....
Illinois	351,289	2,198	.....
Indiana	157,896	167	2,108
Iowa	78,739	730	.....
Kansas	51,932	60,233	85,996
Kentucky	39,386	351	.....
Louisiana	14,560	29,419	47,458
Maine	348	7	.....
Maryland	23,657	18	1,500
Massachusetts	143,453	14	.....
Michigan	124,841	104	.....
Minnesota	46,346	992	.....
Mississippi	16,542	349	.....
Missouri	90,495	19,580	.....
Montana	5,686	563	960
Nebraska	32,984	3,349	.....
Nevada	180	1,044	.....
New Hampshire	3,696	20	.....
New Jersey	116,525	103	.....
New Mexico	4,438	1,360	.....
New York	363,319	546	164,408
North Carolina	16,234	20	.....
North Dakota	17,116	504	.....
Ohio	321,987	842	[b]323,020
Oklahoma	13,153	5,594	440,094
Oregon	433	14,345	.....
Pennsylvania	408,264	14	54,450
Rhode Island	22.024	.....	.....
South Carolina	9,540	33	.....
South Dakota	12,325	3,463	.....
Tennessee	28,724	84	.....
Texas	34,789	181,318	179,760
Utah	61	.....	.....
Vermont	412	2	.....
Virginia	22,475	13	.....
Washington	3,473	18,804	.....
West Virginia	70,717	58	142,688
Wisconsin	77,139	662	.....
Wyoming	19,907	2,539	18,349
Total	2,931,037	822,783	1,740,740

[a] Artificial gas; [b] 67,156 artificial gas.

Some Causes of Breakdown to Electrical Machinery

Deterioration of Insulation Due to Dirt, Mechanical Stresses, Etc.—Ventilation, Metal Fatigue, Bearings and Other Causes of Trouble — Typical Examples of Breakdowns Met in Industrial Plants

By W. C. WORRAL

IN probably no other type of machinery are the causes of breakdown so numerous as in electrical machinery. The proper knowledge of breakdowns and their causes cannot be obtained only by a study of machines returned to the shops for repairs, but a full acquaintance with the conditions under which the machines operate is essential. A single breakdown may teach much, but when the same kind of breakdown is experienced many times deductive reasoning and a comparison of conditions and circumstances will generally lend to definite and accurate conclusions.

Dirt and Dampness Affect Insulation.

The vast majority of breakdowns have but one cause and no exact scientific knowledge is required to understand it. Dirt or, as it has been defined, "matter in the wrong place," is responsible and no precaution can be considered unnecessary which will prevent dirt obtaining access to the internal parts, such as the commutator, armature winding or field coils. Dampness, oil and dirt are the greatest enemies of insulation; dampness and oil are not so serious in themselves but the danger lies in their forming a conveying medium for all kinds of injurious matter.

A certain hydroelectric station was shut down for two years, the insulation resistance of the machines was practically zero and yet without any preliminary drying they were started up and put on load; after a few weeks' service the machines had an insulation resistance of infinity. These machines have since given years of service without any breakdown. Such a case is exceptional and is due to the fact that the atmospheric moisture was pure and the insulation had not suffered any deterioration.

The presence of dampness frequently causes repairs on the site to turn out very unsatisfactorily. The insulating materials may be dry when taken out of storage, but by the time they are put into the machine they are very likely to have absorbed moisture and the varnish is applied without "stoving." A very bad example of this kind occurred in a coal mine. An underground three-phase motor of 90 hp., 2650 volts, coupled to a pump broke down to ground in the stator and was repaired in position. The repaired coil broke down again in a week and as the owners refused to bring the motor to the surface, the repair was again effected in the pump chamber underground. A month later the repaired coil broke down once more and the owners then allowed the motor to be sent to the makers' works. A repair was again effected but under favorable conditions and no further trouble was experienced.

Where failure of insulation occurs, a green discoloration is sometimes observed near the point of breakdown and there seems little doubt that the discoloration is in some way associated with the failure. Chemical analysis shows that where the discoloration occurs chlorine is frequently present. One possible source of the chlorine is soldering flux. Zinc chloride has been found present in considerable quantities even in soldering paste which is guaranteed to be free from this substance. Ordinary soldering "spirit" is used in most shops for the purpose of cleaning the soldering iron and for tinning the conductor ends. A common practice is to dip the hot metal into the spirit, which splashes all round and it is quite conceivable that spots reach parts of the machine which are supposed to be entirely free from such materials. The green discoloration may also be due to the vegetable and fatty acids contained in the flexible varnish with which the insulation is impregnated. It is generally admitted that some action takes place during the process of oxidation of the varnish and even when the varnish has hardened further action may take place which may adversely affect the insulation that the varnish is supposed to protect.

Discoloration has been noticed more particularly in connection with built-up mica used in commutator construction and in this case the discoloration is probably due to the methylated spirit used as a solvent of the varnish or cement employed in the construction of the material. It is practically impossible to make a chemical analysis of the green product as the quantity present is always too small.

A very remarkable series of breakdowns in which the green discoloration was noticed occurred in connection with two 300-kw., direct-current generators and a 100-hp., direct-current motor, all of which broke down in succession at short intervals in exactly the same way. The failure was in each case due to short-circuits between the commutator segments at the bottom of one of the V-grooves. There was no sign of any foreign matter present, but around each place where a short-circuit had occurred the micanite and the copper were discolored green. The short-circuits were most likely due to the action of the solvent of the varnish on the copper, but there was also the possibility of traces of soldering spirit or even soldering paste being present. The soldering paste used was found to contain zinc chloride and the micanite also showed traces of chlorine.

Although it is suggested that in many cases of breakdown the cause lies in the nature of the insulating materials, similar machines made of the same batch of materials at the same time do not all show the same defects. The 300 kw. generators and 100 hp. motor cited above were only three machines of a 600-kw. installation, comprising chiefly, motors of 10 hp. and upwards. The remainder of the ma-

chines proved satisfactory and other machines turned out by the makers at the same time were free from defect. This naturally throws some doubt on the conclusion that the fault was inherent to the materials, for the question is at once asked, why had not other machines failed in the same way? At the same time it must be admitted that the failure of three machines in the same way is better proof that the material was faulty than the survival of the other machines was proof that the material was good. No really conclusive explanation of this particular case was arrived at, but after rebuilding the commutators the trouble was not experienced again.

Bad Effects of Producer-Gas Fumes on Insulation.

Producer-gas fumes have a very bad effect on insulation. More than one person who should be an authority on the subject has stated that the fumes have no bad effect on the insulation and the only trouble is with the conducting deposit behind the commutator. This deposit is a very fair conductor, but the effect of the gas fumes on the cotton insulation is very serious. When the armature is wound it should be dried *in vacuo* and thoroughly impregnated with a flexible varnish; merely painting with varnish is quite inadequate. Some makers have tried impregnating with gum, which is very effective, but in the event of repairs being necessary the removal of a coil is a very difficult matter. Although the insulation may have perished, it may hold together for a considerable time but when one point gives way failures at many other points follow instantaneously. A 300-kw., 220-volt, direct-current dynamo was driven by an engine using producer gas. The insulation resistance of the field coils steadily diminished to a very low value; there was, however, no sign of any actual failure until suddenly all the ten coils burnt out together. The commutator of a machine subject to gas fumes becomes coated with a copper salt, probably a sulphide, which is sufficiently non-conducting occasionally to prevent a dynamo exciting.

Conducting deposits which lodge underneath the overhang of the armature conductors at the commutator end cause the greatest trouble where they form a leakage path between the bare copper ends of the conductors and the armature spider. Much can be done by insulating the conductors right up to the commutator lugs and by varnishing the metal, but a more effective preventive is to increase the length of the leakage path and exclude all crevices where the deposit may lodge. The actual way in which this may be carried out depends upon the design of the machine, but generally a sheet of press-spahn is laid between the armature conductors and the supporting ring, the sheet is bent over and tied to the spider arms. In this way a smooth inclined surface is provided upon which the deposit cannot accumulate. For insulation, mica or micanite should be used wherever possible, as these materials resist the action of the fumes better than cotton.

The precautions suggested will greatly improve the running of electrical machines subject to producer-gas fumes, but the most effective precaution of all is to ventilate the engine room in such a way that the fumes cannot reach the machines. There should be no opening in the wall between the producer plant and the engine room, or if an entrance is necessary the door should be opened as little as possible and made to close automatically. The ventilation should be so arranged that the inlet of fresh air is close to the generators so that the gas fumes do not pass over them. Most engine houses are arranged so that the mail door and windows are near the generators, but they act as inlet or outlet according to the direction of the wind; a fan should always be provided to ensure that the air currents flow in the required direction. In the absence of a fan, a ventilator in the roof directly over each generator is of great assistance in maintaining a good atmosphere round the machines.

The effect of chemical fumes generally is much accentuated by the presence of dampness and every precaution should be taken to keep the windings dry. When a machine is not in use, incandescent lamps should be kept alight inside the enclosing case and the windings should be frequently cleaned, "stoved" and varnished, if the machines are to be kept free from an abnormal number of breakdowns.

Conducting deposits behind the commutator are not always due to gas fumes but may come from the general dust in the atmosphere. Direct-current turbogenerators run great risk of failure in this respect and should whenever possible be provided with filtered air. In the power house of an iron works two 450-kw., 220-volt, direct-current turbogenerators running at 2250 r.p.m. were run for about 12 months without being opened up for examination and cleaning. Eventually the equalizing connections at the back end of the armature of one machine burnt out and a fortnight later the armature of the other machine broke down in the same way. On examination it was found that a mixture of coal and iron dust and oil had collected underneath the connections to the commutator and had set up short-circuits between the conductors. The coal dust was burnt to ash, but the insulation of the armature conductors was undamaged except where the burning had occurred. The equalizing connections, however, were of much smaller section than the armature conductors and had overheated and burnt out. It was found necessary to strip and completely rewind both armatures in order to fit new insulation at the back end. The strong draft of the generators had drawn in dust from the atmosphere and oil from the bearings, and the mixture had not only lodged behind the commutator but filled up the air gap solid and partly choked the outlet grids on top of the machine. After the accident, air filters were provided with very satisfactory results.

A low or high insulation resistance is not always a reliable guide to the real condition of the insulation. A machine may have a low insulation resistance and yet the insulation may be in excellent condition. The pores of insulating media cannot be so impregnated or coated with varnish as entirely to prevent the access of moisture, and all varnish cracks and opens out after a certain time. On the other hand, if moisture be absent, and there is no actual fault, a machine may have a very high insulation resistance and yet be in very bad condition owing to real deterioration of the insulation.

Effect of Mechanical Stresses on Insulation.

The insulation used in electrical machines is of necessity for the most part of a very flimsy nature from a mechanical point of view and although the machines may be designed so as to relieve the insulation of mechanical stresses to a very great extent, there are still stresses due principally to electromagnetic causes which seriously endanger the machine. Generally the stresses cause a slight movement when the load is suddenly changed or the current is switched

on or off, and in time the movement causes abrasion of the material. This is particularly the case with field coils. In the old days the coils were wound on metal formers and the insulation was protected, but in most modern machines the coils are only taped around and wedged on the poles to prevent movement. When, however, a coil repeatedly expands and contracts, due to heating and cooling, it often becomes loose and on switching the field current on or off the coil is moved on the pole so that in course of time the conductor becomes grounded. If the coil is on the top of the machine considerable difficulty is sometimes experienced in detecting the fault, as when the machine is running (and cannot therefore be tested) the coil is lifted and the ground appears, while when the machine is stationary the coil is resting on the pole shoe and the ground disappears. The absence of the metal former has, of course, many advantages, but if it is discarded much stronger insulation should be used and the coils more effectively secured. Another weak point is found at the end of the armature slots; in some makes of machine the coils are bent round too sharply and the edges of the slot are not sufficiently insulated.

Troubles Due to Ventilation.

The power which a modern machine will develop is generally limited by the permissible temperature rise and the actual temperature rise depends upon the effectiveness of the arrangements for dissipating the heat generated. The problem is of very pressing importance in high-speed turbogenerators where the radiating surfaces are of relatively small extent. There is not much difficulty in ventilating the stator, but the rotor presents a more difficult problem. In some makes the air passages are radial while in others they are axial. Designs are, however, continually being varied and experience has not yet led to the general adoption of any particular method or design.

The air is forced into the rotor either by fans on the generator shaft or by an external motor-driven fan, and apart from the extra cost, the advantage seems to lie with the latter system. The higher efficiency of a properly designed motor-driven fan over the type of fan usually fitted on the generator shaft appears to compensate for the extra loss incurred in driving the motor. Many generators have fans which are very badly designed and finished, thereby seriously impairing the efficiency.

In the case of an alternating-current turbogenerator, the rotor of which seriously overheated, the fan on the generator shaft had an outer set of blades to supply air to the stator windings and partly ventilate the stator core, and an inner set which was intended to supply air to the rotor and through the rotor to the stator core. The effect of the rotor fan was tested by arranging baffles to cut off the action of the outer fan and it was found that practically no air passed through the rotor. This was no doubt due to grooves which were cut in the taper portion of the rotor shaft between the fan and the rotor to conduct the air but which apparently acted as fan blades in opposition to the fan fitted on the shaft. The result of this test was confirmed by the fact that when the generator was opened up the rotor ventilating ducts were found to be quite free from dust while the stator ducts were dirty. The difficulty was overcome by cutting away the fan and installing a motor-driven external fan which produced sufficient pressure to force the air through the rotor.

Wherever there is the slightest risk of dust entering a turbogenerator air filters should be provided. Even dry dust will become hard and closely packed under the action of centrifugal force and will fill up the ventilating ducts and interstices of the windings. The rotor of a 1500-kw., three-phase turboalternator running at 3000 r.p.m. completely burnt out due to the ducts and windings being choked with cement dust. Two air filters were in use, a dry filter in a room below the turbine and directly in the main air passage and a wet filter through which the air entered the room. All the air passed through the dry filter, but it was out of order and inefficient. The wet filter would probably have been satisfactory, but a door into the room was not sealed and was often open so that the wet filter was not fully in the air circuit. The whole arrangement was badly designed and of very little use.

The design of fan which is fitted to motors is often very weak mechanically, the blades are badly secured and are liable to break away from their fastenings. In the case of a 100-hp., three-phase motor that was pipe-ventilated the blades came out through the air outlet, having been thrown up a vertical pipe 6 ft. long, round a right-angle bend and along a pipe several feet before reaching the exit. A new fan was installed but the same thing occurred again; after this series of accidents the fan was redesigned.

Troubles from Faulty Core Construction.

One would hardly think it necessary to have to emphasize the necessity of thorough mechanical construction in connection with stator and rotor cores, yet a few examples will suffice to show that this is the case.

In a two-phase induction motor of 180 hp. the rotor core plates were clamped between two end rings by means of bolts passing inside but not through the core ring. The core was keyed at one point onto the rotor arms, but the end rings were secured only by small grub screws, half into the end rings and half into the rotor arms to prevent longitudinal movement. The rotor core was thus in the form of a ring which was entirely separate from the rotor arms or hub. Shortly after the motor was started up for the first time the rotor fouled the stator and considerable damage was done to several stator bars. On examination the rotor was found to be slightly eccentric and was ground true on the outside; the motor was re-erected, but the same accident occurred again and this time it was said to be due to a slight movement on the part of the pedestal bearings. After adjustment the motor ran satisfactorily again, but each time the motor was switched off a noise was heard which indicated that at a certain point in each revolution the rotor core moved on the hub. It was also noticed that when the rotor was hot a 6-mil feeler could be inserted between the core and the rotor arms in the region opposite to the keyway, but when the rotor cooled down the space was quite closed. It was evident, therefore, that the core was loose and this probably accounted for the apparent eccentricity of the rotor in the first instance. The rotor was properly secured to the hub by screws through the arms and into the end plates, and after this had been done all symptoms of looseness disappeared. It is interesting to note that the makers have since changed their design of rotor.

A 750-kw., 2200-volt, single-phase alternator running at 490 r.p.m. began to give a great deal of trouble

within a few weeks of its erection. The tooth stampings of the stator in the neighborhood of the ventilating ducts and at the ends of the stator broke off, forming in course of time holes one or two inches long between the conductors; small pieces of metal came away while the machine was running and, being carried around in the air gap, caused violent sparks to be emitted; eventually the conductors at one point were grounded and a large hole was fused in the conductors in three adjacent slots and the two teeth between them. An attempt was made to improve the machine by painting the entire surface of the stator with shellac and plaster of paris and the holes as they occurred were filled in with the same material. The fault in this case was due to insufficient support of the stator teeth and it is quite probable that the entire stator core was loose. The distance piece in the core duct consisted of a thick stamping with the teeth twisted through a right angle. The method of repair adopted did not prove very satisfactory and later fiber wedges were driven into the ventilating ducts which proved successful in preventing further teeth breaking.

A three-phase, 750-kw., 440-volt turbogenerator running at 1500 r.p.m. after eight years gave serious trouble by one line of tooth stampings breaking off and grounding the stator bars on each side. It is quite possible that the trouble had been going on for some time, but it was not observed until the bars were grounded.

Some manufacturers do not appear to realize the necessity of providing effective support for the teeth of rotor and stator cores. The magnetic pulsations which occur do not exert any considerable force, but are of very high frequency and it is most probable that after a time the metal becomes fatigued and breaks off. The effects of fatigue are sometimes not apparent until the machine has been running for some years, as in the third example given above.

Core looseness is a frequent source of trouble in small machines, although it is so easy to avoid it by proper design and workmanship. Armature and rotor cores should always be built up on a cast-iron spider or sleeve, as this provides a much sounder mechanical construction than when the core is built directly on the shaft. Bad workmanship can, however, defeat good design and when shafts and spiders are packed in with strips of metal, as is occasionally the case, a loose core is only to be expected. The present-day method of securing armature and rotor cores by circumferential keys is generally satisfactory, but great pressure must be applied to the core before fitting the keys, and the keys must be a good fit. Some makers have not the requisite plant for this and are able to apply pressure to the core only with screw clamps. The keys in one 200-kw., direct-current machine dropped out and the core plates were held together only by the armature conductors. After running in this condition the conductors grounded to the core and on dismantling the fault was discovered.

Many manufacturers use a standard key and make up any slight variations in the length of the core by running in soft metal behind the key; this scarcely seems a workmanlike job.

Wood blocks are sometimes used as distance pieces in the core ventilating ducts; this is bad practice, as the wood is very liable to become loose.

Defective Connections.

The connections, external or internal, to a machine or switch are often very badly made and many serious accidents have resulted; a few examples will be given:

A 175-hp., three-phase induction motor supplied from a private plant in a mill, commenced to hunt and the hunting gradually increased in violence until the entire electrical system was surging, with the result that circuit-breakers tripped and the entire mill stopped. This occurred several times; the load on the faulty motor was then reduced and the hunting was kept within such limits as not to disturb other portions of the system. The trouble was found to be due to a bad connection in one phase of the rotor starting switch. The connection consisted of a projecting stud on which was placed a cable lug secured by two nuts. The inner nut had crossed threads and although tight, pressed on the lug in one part only and the locknut was on for only half its thickness. Overheating had caused the contact surfaces to become fused and eventually contact was practically broken.

A 70-hp., three-phase motor overheated considerably although three other similar motors doing similar work ran quite satisfactorily. The fault was found to be due to a contact in the star-delta starting switch, which was entirely missing so that although in star connection the motor was on the three phases of the supply, in delta connection one phase was cut out.

Two 600-kw. turboalternators running at 3000 r.p.m. broke down in succession after a few hours running, owing to the rotor connections breaking off close to the slip rings. The connections were not properly secured. The rotor winding broke down to ground some time later and when opened up it was found that, although the connections at the slip rings had been made secure after the breakdown, they were left quite loose inside the end bell and the insulation was almost rubbed away by abrasion against the inside of the fan casting.

Vibration and Fatigue of Metal.

Fatigue of metal is a very serious problem in the internal connections of an electrical machine. Vibration caused by lack of balance, loose foundations or relative movement of parts, sets up tremors which in course of time seriously weaken the metal. The most common occurrence is in the commutator connections of ordinary direct-current motors and dynamos, but many other more serious examples have occurred, a few of which will be given.

A 450-kw., direct-current turbodynamo running at 2500 r.p.m. broke down owing to a commutator lug breaking at a point about ⅛ in. inside the commutator segment; the lug was ripped off the upper armature connection but carried away a piece of the lower connection.

A 370-kw., direct-current turbodynamo running at 2500 r.p.m. failed repeatedly owing to the commutator lugs breaking at the corners. The lugs had sharp bends, but when new lugs without any sharp corners were fitted the trouble was not experienced again.

The exciter of a 750-kw. turboalternator running at 3000 r.p.m. broke down in the commutator, the copper segments cracked across and the lower part of the V of one segment broke off. The armature was badly balanced and the vibration was no doubt responsible for the breakage.

The rotor of a 125-hp., three-phase induction motor was wound with enameled strip copper; the overhanging end connections were, however, not mechanically secured, in fact were quite springy. The high-frequency rotor currents during the starting

operation caused the copper strip to vibrate and in time a succession of breakages occurred. In later designs of this type of rotor winding the end turns are secured by wire threaded through them but even with this method some turns are often found loose.

The necessity for the security of terminal connections and other parts cannot be too strongly emphasized as very serious risk of breakdown and fire is often caused by faults in this direction.

An induction motor with a squirrel-cage rotor is usually considered a most robust piece of machinery, but unfortunately this very fact often causes the motor to be subjected to such arduous conditions of work and great abuse as no other type of motor would withstand, and as a result it is on the average no freer from breakdowns. Except in the more recent designs, the rotor is the weakest part. The contacts between the bars and the end rings become overheated and loose and the stator frequently burns out due to the increased current taken by the motor.

The modern methods of brazing the joints, casting solid or welding are all satisfactory, but soldering and riveting are of very little use. If the joints remain good, a rotor should never need rewinding, even if the insulation of the bars in the slots is all burnt away.

Bearing Troubles.

Bearings are frequently the cause of serious trouble. A seized bearing is often a small matter compared with the damage which follows. It is this which makes a phosphor-bronze bushing preferable to white metal, except in large machines which receive more attention and where the air gap is large enough to prevent any consequential damage. When the bearing heats up the white metal melts out and allows the rotor or armature to drop onto the stationary part and damage the windings, whereas a phosphor-bronze bushing seldom causes such damage. The bushing is more difficult to remove when seizure takes place, but that is not a serious matter. If the hot bearing is discovered in time and the machine is kept running while the bearing cools down, actual seizure may be prevented. Ball bearings are advocated by many makers, particularly for induction motors where the air gaps are very small, but these are not always very reliable in practice. While such bearings are suitable for steady drives where there are no sudden jolts, such as occur in a stone or ore crusher, they are supplied by some manufacturers for all purposes without any discrimination. The jolts usually cause broken balls and the only remedy is to substitute bushed bearings. Apart, however, from unsuitability under certain circumstances, one of the main troubles is in connection with the fitting of the bearings. The importance of this cannot be too strongly emphasized as carelessness is responsible for many breakdowns, and a repair usually involves a complete new bearing which is an expensive item.

Oil throwing is another bearing trouble and it seems curious that in a series of motors built to the same standard one will throw oil while the others may be quite satisfactory in this respect. The forces which draw the oil out of the bearing are of very small magnitude and the points to be observed in order to prevent the trouble would, to an inexperienced mind, seem very trivial. Oil throwing can be prevented and it is pleasant to find that the best class of manufacturers are now running no risks and take proper measures without first trying to do without them. Some machines seem to develop oil-throwing properties some time after they are put in service. This may be due to the special circumstances of the drive, such as the shape and size of pulley, the belt, arrangement of the ventilation; it may also be due to the nature of the lubricating oil, but is generally due to dirt on the oil-throwers. The presence of very little dust will allow oil to creep past the oil-throwers and the centrifugal action, which the oil-throwers are supposed to cause, is of no avail. Oil-throwers should be turned solid with the shaft, as if they are loose, oil will sometimes creep along the shaft under the oil-thrower.

Access to bearings during running is of great importance. Great carelessness is often shown in the arrangement of the pulley in two-bearing machines. The pulley often is so close to the bearing that the inspection hole is surrounded and the rings cannot be seen at work. At one works not only was this the case but the outer bearing was in a hole in a brick wall.

Care Best Preventative.

Case after case could be cited of costly breakdowns which might have been prevented by a little more care in connection with the bearings.

Some manufacturers do not take the trouble to make any inquiries regarding the conditions under which the electrical plant is to work, and many of the troubles which are experienced might be obviated if some attention were paid to suitability. It is often a question of price and the manufacturer may find it difficult to persuade a customer to pay extra for a more suitable machine or switch; but there are many cases in which price scarcely comes in and it is only a matter of thoughtlessness on the part of the designer of the installation. For instance, many excellent installations are considerably reduced in reliability by a poor quality of regulator in the exciter circuit, or a weak crossbar on a circuit-breaker; locknuts are usually left off the connections behind the switchboards; the springs on motor switches are often not securely attached; the handles on starting switches break off or become loose; switch and fuse contacts open and lose their springiness. Examples will, no doubt, occur to everyone and it seems a great mistake not to pay more attention to such matters.

The contract for the electrical equipment of a certain cotton mill contained a clause that if during the guarantee period the entire mill were stopped for a continuous period of two hours due to a fault, a heavy penalty could be enforced. The generator, cables, motors and motor switchgear were all of first-class quality; nothing in the workmanship was left to chance, yet the regulating resistance in the shunt circuit of the exciter was of the most indifferent quality. This resistance showed signs of overheating and as a precaution a second resistance of the same pattern was installed by the contractor as a standby. It was fortunate that the precaution was taken for one or other of the resistances failed several times, before a more robust piece of apparatus was supplied.

COLORADO STATE ROAD TO BE ILLUMINATED.

According to recent press dispatches, plans have practically been completed by the Colorado State Highway Commission for illuminating the road between Colorado Springs and Denver, Colo. This road is 75 miles in length and, according to the chairman of the commission, it will be the only one of its kind in the world when completed.

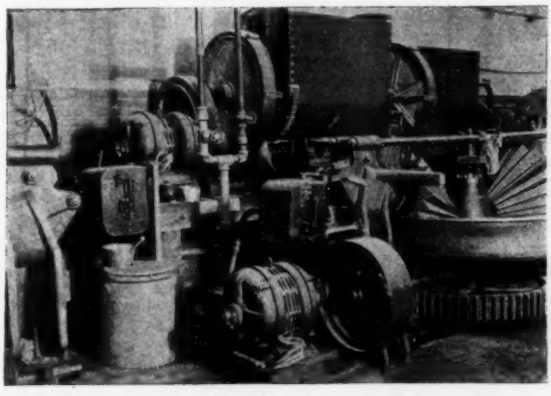
The Application of Electric Drive in Macaroni Plant

Features of Installation at Fould's Milling Co., Libertyville, Ill.—Advantages of Central-Station Service for this Work—Description of Process

By PAUL B. FINDLEY

CONTRARY to the general impression, the process of making macaroni and other alimentary pastes is essentially one of manufacturing rather than baking. Moreover, the amount of power used in the process is considerable and easily adapted to the application of electric drive. On this account and because very little heat is required in the process which makes it desirable to purchase the electric service needed, central-station companies find such industries ready to adopt their service which usually proves profitable and advantageous to both, especially when the efforts of both are united to secure the most efficient and productive installation.

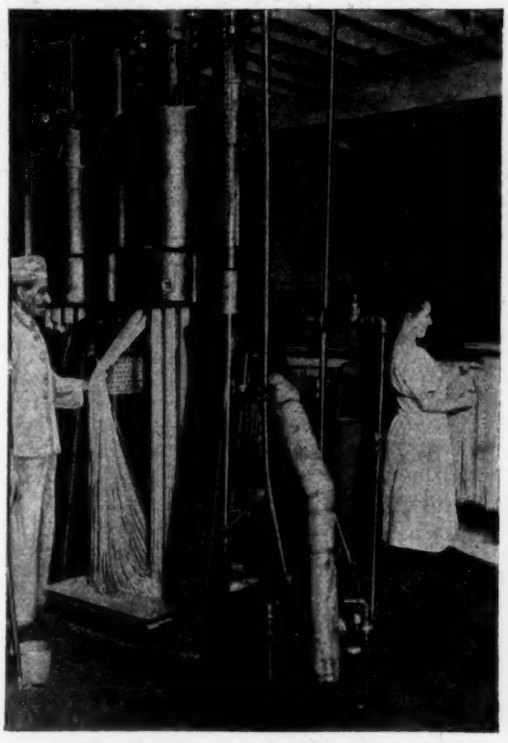
An interesting example of such co-operation between a central station and an industrial plant is that of the macaroni plant of the Foulds Milling Co., at Libertyville, Ill. When this plant was acquired, the



Westinghouse 15-hp. Motors Driving Mixer (Above) and Kneader (Below).

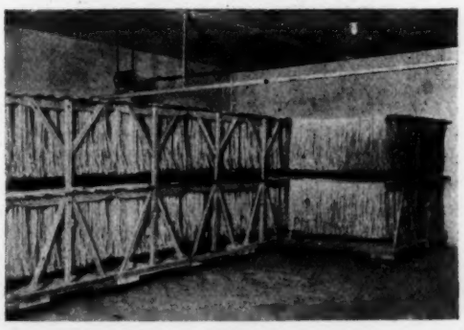
Public Service Co. of Northern Illinois got the opportunity to make a study of the possibilities, and as a result complete electric drive was installed, nearly all the apparatus being individually driven and the installation has proven very satisfactory. As a bit of personal interest, it might be added that Glenn A. Hoskins, who engineered the work for the central-station company, later became manager of the plant.

In this plant, the principal ingredient, flour, is received in barrels and taken up a conveyor to the sifting and storage rooms located on one of the upper floors. From this room it is run through chutes in appropriate quantities to the mixers on the floor below. Each mixer has two curved knives which, revolving, cut and fold the flour as water is added by the operator. When the mixing operation is completed, the dough is dumped into the pan of the kneading machine. This pan is turned under large toothed wheels, which knead the dough until all the lumps have been broken up and the mass is of uniform consistency. For these operations 15-hp. squirrel-cage motors are used on the newer mixing units and similar 10-hp. motors for the kneaders.



Macaroni Press at Fould's Milling Co. Plant.

After it is kneaded, the dough is cut into blocks and taken to the presses where it is forced under pressure through holes, giving it the desired shape and size. Each of these presses has two cylinders, one of which is charged while the other one is under the press. In the bottom of each cylinder is a die-plate with the appropriate holes. In the cylinders a pressure of 3400 lb. per sq. in. is obtained. Oil is used in the press cylinders and the pressure is obtained from



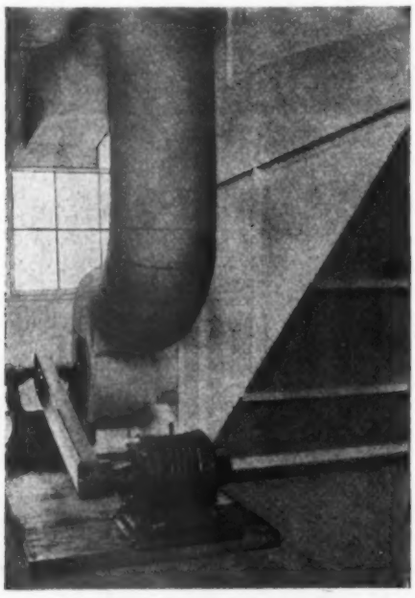
Macaroni Drying Room at Libertyville Plant.

a battery of heavy duty pumps driven by a 30-hp. type CW Westinghouse motor.

As the long strings of dough come out of the orifices, they are cut in suitable lengths and hung on wheeled racks which are then taken into the drying chambers. The drying operation is one requiring very close control of the humidity of the air. In the drying rooms of the Foulds' plant it is secured by passing the air through a Carrier air conditioner. Motor-driven fans drive the air through a spray chamber and over heating coils; other fans exhaust it later from the drying rooms.

Macaroni Saws Driven by Westinghouse Type-CS Motors.

When the product is thoroughly dried, it goes to circular saws, each driven by a 5-hp. Westinghouse motor where it is cut in lengths suitable for packing. It is then sent in containers down a conveyor to the packing room on a lower floor. This conveyor is motor driven and arranged so that it can be operated in the reverse direction to bring back the empty containers. The conveyor motor is controlled from either floor by three-way snap switches and a Westinghouse reversing-contactor panel.



Motor Driven Exhaust Fan.

The familiar yellow-and-red cardboard boxes in which the Foulds macaroni is sold are received flat and are opened and placed in automatic motor-driven box-sealing machines, of which three are installed. In these machines they are shaped, filled with the product—macaroni, spaghetti or noodles—and then sealed. They are then taken to the shipping room and packed in cartons for shipment. One sealing machine is driven by two 2-hp. Westinghouse motors; the other two by a single 5-hp. motor.

In the manufacture of noodles the process is slightly different. In addition to flour and water, eggs are also mixed into the noodle dough. The dough is rolled into a thin flat sheet and cut into ribbons by a gang of knives. Then it is further cut into shorter pieces which are placed on shallow wire trays. These trays are stacked one above the other in a conditioning room, over a wind box connected to the intake sides of several disc fans. Two such fan units are installed, each consisting of a Westinghouse motor belted to two fans. Each fan is in turn connected to three stacks of trays. An older form of dryer is served by a blower driven by a 5-hp. motor. This dryer is equipped with wire-bottomed drawers through which the air blows.

Automatic Box Sealer Driven by 2-hp. Motor.

The electric power for the operation of this plant is furnished by the Public Service Co. from its 4000-volt three-phase lines through a bank of three transformers. The service used in the plant is three phase, 220 volts for power and three wire, 110-220 volts for lighting.

COST OF RUNNING ELECTRIC VEHICLE AT KETTERING (ENG.).

Municipal Truck Hauls Coal and Clinker at Cost of 46 Cents Per Ton.

A "G.V." electric vehicle of 3½ tons operated by the Kettering (Eng.) municipal electric supply department gave the following results for its second complete year's running, that is, from April, 1918, to March, 1919. The coal carted was 6839 tons and the clinker 1263 = 8102 tons. Cost per ton 46 cents; mileage 4392. The detailed figures for the year are as follows:

Depreciation, 10% on chassis less battery and tires, *i.e.*, $3900	$ 390
Increase at 5% on decreasing capital or 2½% on $3900	100
Current, 5958 units at 4 cents per unit	250
Tires, 4392 miles	85
Battery upkeep	500
Insurance	65
Wages (driver and mate)	2,050
Repairs, oil, etc.	485
Total	$3,925

NEW ELECTRIC AUTOMOBILE CONTAINS MANY NOVEL FEATURES.

Light Weight and Low Cost Promise Great Field for New Vehicle—Features of Design.

The coming "Ford" of electrics is the claim advanced by its manufacturers, Henry E. Dey, Inc., for the Dey Electric automobile. This car will be remembered by many as it created quite a sensation at the time of its introduction some years ago. At that time a company was formed for its manufacture and sale but very little was done. The new company was recently incorporated for this purpose and expects to put this machine on the market shortly.

The Dey Electric differs in many respects from any other electric automobile produced at this time especially as it is very light in weight and consequently much cheaper in cost. In order to cut the cost and weight of the cheapest and lightest electric now on the market in half, and at the same time not reduce the factor of safety or size of the car, which has the same dimensions as the Ford, it naturally follows that it must have many new features of design.

The most revolutionary change is in the motor and gearing. The motor has both its armature and field magnet rotatable, one element connecting with one driving wheel through a pair of reduction gears, while the other element connects in a similar manner to the other wheel. This arrangement produces a perfect differential substitute and, in addition to saving in its cost and weight, it is claimed to increase the capacity of the motor 100% for a given rotative speed. The reason for this is that the parts revolving in opposite directions cut the magnetic lines twice as fast, thus producing the results of a motor of double the velocity, which also adds to its electrical efficiency. The weight of the motor is still further reduced by placing the armature, which is a toothed Gramme ring, so that it surrounds the field. The field has six poles, all energized from one coil, and is especially designed for low field losses and light weight. The total weight of the field with shaft is less than 20 lbs. The total weight of the motor, which has a capacity equal to many heavier standard automobile motors is 51 lbs.

The commutator is of the face type, inclined at an angle of 10° in order that the brushes will have a similar inclination. The purpose of this is to neutralize the increased friction of the brushes against their holder caused by centrifugal force against the brushes at high speeds.

The motor is centered on the center line of the axle. An eccentric, of 7/32-in. throw, is fixed to the outer end of each shaft. An internal gear is carried by and rotates upon the field shaft eccentric. An external gear, concentric with the shaft, is keyed to the stationary housing and meshes with the internal gear which connects by means of a flexible jointed shaft to the wheel hub. It will be noted that only one of the gears is rotatable, the other one being held absolutely rigid. At the armature end the construction differs by mounting the external gear, instead of the internal one, upon the eccentric, and keying the internal one fast to the housing. From this point the construction duplicates the other end.

When the internal gear is the rotative element, as at the field shaft end, the direction of rotation remains unchanged between the motor and the wheel, but with the external gear as the rotating member, as used at the armature end, the direction is reversed. The opposing directions of the motor elements are thus rectified without recourse to intermediate gears.

Because of the large diameter of the pinion

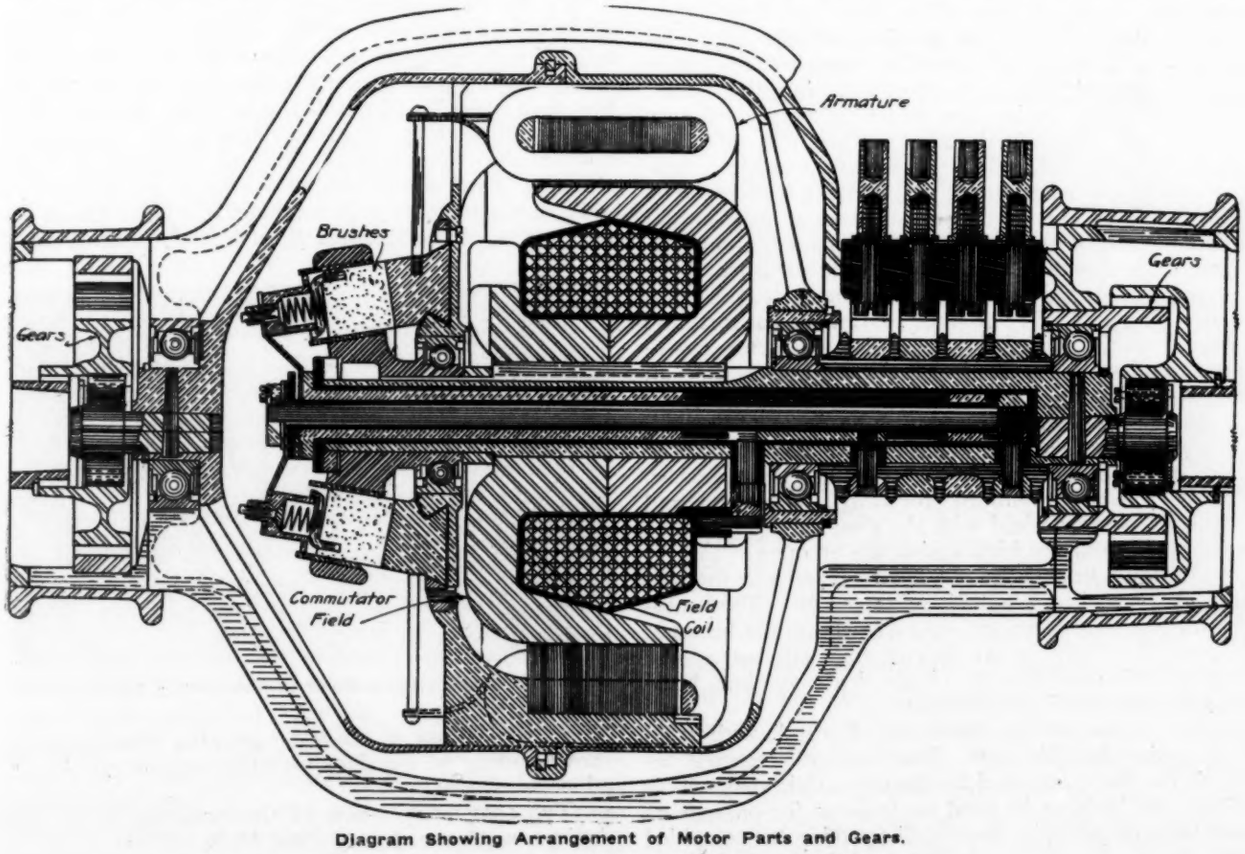
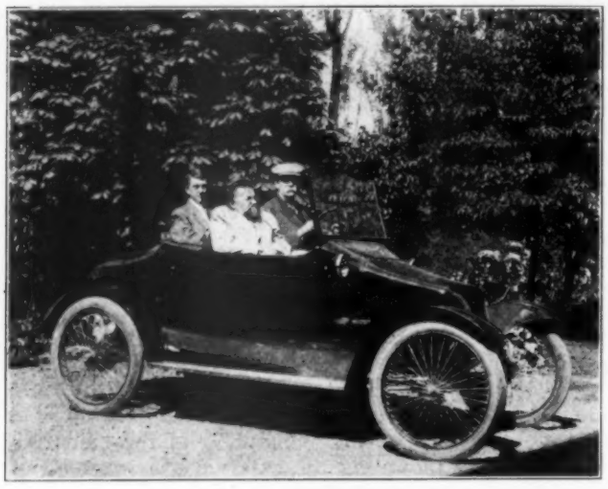


Diagram Showing Arrangement of Motor Parts and Gears.

element and the consequent large arc through which the gears mesh, dividing the stresses through a large number of teeth, they are very durable. This feature also provides noiseless operation, minimum wear and high efficiency, for there is practically no rubbing action during contact to cause noise, wear and friction.



"Dey" Electric Experimental Car.

The total weight of the four gears, two on each end, is 4⅝ lbs.

The axle is made up of a steel housing for the motor and gearing at the middle section, with steel tubing extensions to the wheels. Caps covering the gears hold the power plant in position; these caps are held in place by taper rings that can be driven off in less time than would ordinarily be consumed in removing a single bolt or nut. These rings also retain a light aluminum cap that covers the unprotected side of the motor. The current is taken into the motor by means of slip rings and there is, therefore, no necessity of disconnecting wires when removing the motor.

In the latest design the control is very similar to that of a gas car with the gear shifting left out. For speed variation a foot lever is used in a manner identical with that of a clutch lever. When the foot is removed from this lever the car runs at full normal speed. A slight pressure inserts resistance, giving the effect of a slipping clutch, and as the pressure is increased, resistance is added, until the current is completely shut off. Any further movement converts the motor into an electric brake, and an extreme movement applies the mechanical brake. There is also an additional emergency brake, and as a further means of stopping the car the motor can be reversed through resistance. An accelerator pedal, acting upon the field, increases the speed to 30 or more miles per hr. Another lever providing "forward," "reverse" and "neutral" is interlocked with the speed control, to permit shifting only in high resistance or open circuit.

On down grades the motor recharges into the battery at a speed as low as 3 miles per hr. This automatically slows down the speed as the grade becomes steeper, thus making the driving unusually safe. An increase of speed may be obtained at any time, however, by means of the accelerator.

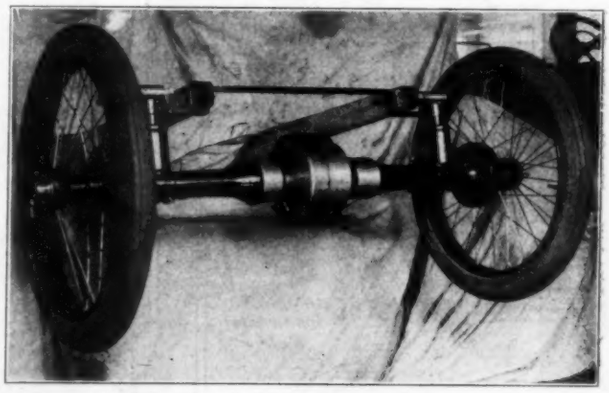
The frame of the chassis is of wood, with truss rods under the side bars. The battery is carried beneath the floor, attached to the truss rod posts. This allows the body to be used exclusively for passengers and luggage, and also avoids all troubles due to spilled electrolyte. The method of suspension is such that the battery can be readily lowered to the floor by one person and the top is accessible for adding water by lifting a trap door in the floor. This location is ideal for obtaining low power consumption and gives a very low center of gravity that conduces to a comfortable riding and safe car. The vehicle is also equipped with air springs.

In the design of this car special attention has been given to keep it as light in weight as possible without decreasing its reliability or limiting its sphere of action. As a result the battery used is also much lighter than ordinary and it is claimed will provide power in excess of 100 miles per charge. This lightweight factor also permits the car to be produced at a much lower cost.

The car is also equipped with a portable charging plant, weighing about 100 lbs., which is carried under the bonnet. It consists of a 4-cylinder, 4-cycle air-cooled engine, minus a flywheel. It is direct-connected to the ring armature of a dynamo, which acts as a flywheel, very similar in design to the motor. The field of this dynamo, however, is stationary. This gas engine can also be used to drive the car, if desirable, and when operated in this manner offers many economies over the ordinary gas automobile.

The gas-engine plant will charge the battery at any time, while the car is running or standing. An automatic switch cuts off the battery and stops the engine whenever the battery becomes fully charged. The dynamo acts as a starter when charging is desired. If the daily mileage is less than the battery capacity the plant can be removed from the car and used as a stationary charging plant for the car or for lighting or other work. It can be easily replaced in the car when necessary. The car will be manufactured both with and without the charging plant.

Up to the present time, due to the incomplete financial arrangements of the company, the final details of marketing the car have not been decided. It is expected, however, that the complete car will weigh less than 1000 lbs. and sell for less than $1000. According to present indications it will fill a long felt want in the electric vehicle line and with the auxiliary charging plant added, should overcome the last argument against this type of automobile. Dr. Charles P. Steinmetz, of the General Electric Co., Schenectady, N. Y., who in one of the accompanying illustrations is shown riding in the demonstration car, is one of its advocates.



The Small "Dey" Electric Motor Is Mounted on the Rear Axle.

The temporary office of the company is at 303 Arlington avenue, Jersey City, N. J.

Editorial Comment

Energy Production and Fuel Consumption of Public Utilities

PRODUCTION of electrical energy by public utilities for the month of March, as compiled by the United States Geological Survey, and appearing elsewhere in this issue, together with the fuel consumption, offers material for considerable thought. The data is not complete, unfortunately, because applying to only about 89% of the total generating capacity of public utility companies, but it may safely be taken as indicating the approximate production by those whose primary function is power production, and the fuel consumption involved.

A monthly energy consumption of 101,400,000 kw-hr. is deserving of special mention. A careful and reasonably close knowledge of the energy consumption for every month of the year is a true index of the industrial activity of the country. Sulphuric acid and several other basic materials have been referred to at different times as the indices of a country's commercial activity, but surely with the rapid growth of public utility supply the kilowatt-hour may come to more truly indicate the status of the country's industrial activity.

To some, the fact that 41% of the total energy generated was obtained from water power may be somewhat of a shock. The fact is that the central stations are better able to utilize water power in a big way than the individual industrial interests because the transmission line modifies geographical drawbacks and links up source of power production with the market for it. Moreover, load-factors of the utility are more favorable for making the hydroelectric development financially worth while. Of course, if a comparison of the total power produced by all producers of power were considered instead of only those producers who have done most to utilize water power, the good showing made by water power in the data referred to would be less pleasing.

Decreasing Electrical Machinery Breakdowns

BREAKDOWNS of electrical machinery do not occur nearly as frequently as in days gone by, thanks to the lessons taught by many years of experience in design, construction and operation of motor, generators and other rotating machinery. When a machine is subjected to much more violent service and abuse than it was designed to withstand it is not surprising when it gives way under the abnormal strain. When a breakdown occurs in perfectly normal service however, it is indicative of faulty design or construction, and the occurrence of failures of this kind from time to time shows that we still have much to learn or at least to put into effect to make motor and other electrical machinery service still more reliable than it is.

For this reason all the information based on experience in investigating and remedying breakdowns should prove of value in making their recurrence extremely rare. The article on this subject, published in this issue, gives such information. The author, Dr. C. W. Worral, narrates a considerable number of interesting experiences in which motor and generator failures were thoroughly investigated until the cause of the trouble was found out and removed. These cases occurred chiefly in English industrial plants and may represent some conditions not so commonly met in American practice. However, most of the lessons they teach are applicable here also.

Briefly, these lessons may be summarized as follows: Use high-grade insulation, carefully applied, and in service protect it from deleterious substances; take pains with the details of construction of cores, connections, bearings, ventilating accessories, etc.; make the construction so rugged as to eliminate metal fatigue due to vibration. These are by no means the only precautions to observe in order to improve the dependability of electrical machinery service, but at times they prove of paramount importance and are therefore worthy of serious consideration.

Why Not Built-In Electrical Appliances?

THERE is an increasing tendency to equip modern apartments and homes with built-in devices such as ice boxes, book racks, buffets and even beds. By so doing great conveniences can often be obtained in arrangement, etc.

It has long been the practice to equip laundries with built-in or stationary wash tubs, thus eliminating the need for lifting tubs and carrying water. The modern electric clothes washer is, of course, a great improvement upon old methods and in certain classes of homes its movable feature is a great convenience which offsets in a way the inconveniences attending the filling and emptying of the washer. Homes and apartments equipped with spacious laundries, however, still lack built-in electric washing machines, yet the machines, with a few minor changes, could easily be adapted to this purpose. The present washing machines can, of course, be permanently located in a laundry and a plumber employed to make desirable plumbing connections and an electrical contractor to install permanent wiring. This, of course, suggests a field that is now being overlooked by electrical

contractor-dealers, namely the installation of permanent, approved types of wiring connections for permanently located washing machines.

The washing machine manufacturers, with perhaps one exception, appear to be overlooking the need for a built-in washing machine that can be installed as an integral part of a laundry just where it is wanted and with its own plumbing facilities that will permit of easy filling and emptying as well as cleaning.

Manufacturers of dish-washing machines are also overlooking the same need. A dish-washing machine is claimed by some to be as much of a bother to keep clean and operate in a family of two as is the old method of washing dishes by hand. A built-in dish washer with its own faucets and drains could be kept clean easier and would most likely meet with good demand from house owners and the higher class apartments.

Although a dish-washing machine leaves the dishes practically dry because of the hot water used, they are not always perfectly dried. This suggests the advisability of combining a stationary dish-washing machine with a dish-drying device that will eliminate hand drying of both dishes and silver entirely by the passage of a current of hot air over the dishes.

It will not be far in the future before people will be demanding built-in laundry and dish-washing machinery because of the great convenience they offer. Tenants do not desire to invest in relatively expensive apparatus for these purposes and to have them add to their moving burdens, yet practically all would most likely be willing to pay a slightly higher rent if these appliances formed an integral part of the building.

Washing-device manufacturers can well afford to give these matters their serious thought and attention.

Reach the Middle Classes First

A PROMINENT department store in one of our large cities that was doing a very prosperous business decided several years ago to remodel on an extensive scale which it did at considerable expense, feeling that its more inviting and pleasing appearance would further increase trade.

When the remodeling was completed, however, its dream failed to materialize. Trade in place of increasing was rapidly declining. Old customers were sought and asked why they had ceased to trade at the store. It was found that a number of women frankly stated that they felt out of place in the store, that they did not feel well enough dressed to enter the store without a feeling of embarrassment due to the store's luxurious appearance and fittings making them feel as if they were poorly clothed and out of place in such an atmosphere. The store then realized the mistake it had made. The bulk of its trade was derived from the middle classes. It could not hope to do business with only the richer classes without sacrificing the greater part of its trade. The store was remodeled again, its luxurious fittings removed and merely an atmosphere of simple refinement without extravagance or show introduced. Trade immediately began to build up again.

This is but the experience of one store. It represents one extreme. The other extreme, too, must be considered. The person of average means feels he is out of place in a store in the slum districts of our larger cities and would feel equally as out of place if such stores were located in better districts but retained their slum atmosphere.

An electric shop to be successful must cater to those classes of people from which it can expect the most trade. This is what is largely responsible for the success of the Ford Motor Company. It realized that the number of people who could afford to buy high priced or medium priced cars were few, that the lower it could make its price, the more cars it could expect to sell and, hence, the greater its success, because of the greater number of people having modest and smaller incomes. Such people form by far the bulk of the population of the world, of our country and of practically all communities.

It is within this class that the greatest number of electrical appliances are sold. The prices of such appliances are within the reach of most pocket books. This, of course, means that the more wealthy classes are also good prospects for the sale of electrical appliances, but being relatively very few in number, a contractor-dealer or a central station cannot afford to cater to them and neglect the middle classes which are numerically much greater, and, hence, represent a better and larger market.

The electrical dealer or central station should, hence, bear this in mind in locating its store, in decorating and furnishing its interior and exterior, in selecting salespersons, in writing and designing its advertising matter, etc. One of the secrets of success in merchandising is finding where one's best and largest market exists and then going after this trade in the manner that this trade demands. The best and largest market for the sale of electrical appliances is among middle classes. It is the market that the central station or electrical dealers should consider first and which will yield the best returns with a minimum of sales effort, advertising effort and expense. The cost of reaching a large fertile market is less per person than the cost of reaching a smaller market.

Greater efforts can be made to reach the richer and poorer classes after the middle classes are being cultivated properly. Advertising and sales efforts designed to reach the middle classes will bring returns also from the richer and poorer classes, more so than advertising and sales efforts designed to reach either of these two classes, will bring results from the middle classes.

Sell the middle classes first—reap the best grain first.

Current Events

A. I. E. E. Committees and Development Report — Joint Convention — Sales Managers Meet — Convention Plans

NEW A. I. E. E. ADMINISTRATION APPOINTS COMMITTEES.

List of Chairmen and Members of Edison Medal Committee Announced.

At the first meeting of the Board of Directors of the American Institute of Electrical Engineers for the administrative year beginning on Aug. 1, 1919, held in New York, Aug. 12, President Townley appointed committees for the administrative year beginning Aug. 1, 1919.

The chairmen of the committees appointed are as follows: Finance—N. A. Carle, Newark, N. J.; Meetings and Papers—W. I. Slichter, New York; Editing—Henry H. Horris, New York; Board of Examiners—F. L. Rhodes, New York; Sections—W. A. Hall, Lynn, Mass.; Student Branches—C. Francis Harding, Lafayette, Ind.; Membership—R. W. Krass, New York; Public Policy—H. W. Buck, New York; Headquarters—N. A. Carle, Newark, N. J.; Committee on Technical Activities—Wilfred Sykes, Pittsburgh; Standards—L. T. Robinson, Schenectady, N. Y.; Power Stations—Philip Torchio, New York; Transmission and Distribution—E. B. Meyer, Newark, N. J.; Traction and Transportation—W. S. Murray, New York; Industrial and Domestic Power—A. G. Pierce, Pittsburgh; Lighting and Illumination—C. E. Clewell, Philadelphia; Economics and Electric Service—William McClellan, Philadelphia; Protective Devices, D. W. Roper, Chicago; Electrochemistry and Electrometallurgy—E. F. Northrup, Princeton, N. J.; Electrophysics—F. W. Peek, Pittsfield, Mass.; Telegraphy and Telephoney—Donald McNicol, New York; Marine—Arthur Parker, Camden, N. J.; Use of Electricity in Mines—W. A. Chandler, Uniontown, Pa.; Electrical Machinery—B. A. Behrend, Boston; Instruments and Measurements—S. G. Rhodes, New York; Iron and Steel Industry—W. F. James, Philadelphia; Educational—J. C. Parker, Ann Arbor, Mich.

In accordance with the by-laws of the Edison Medal Committee the Board confirmed the appointment by President Townley of three members of that committee for terms of five years each, namely: Edw. D. Adams, New York; H. H. Barnes, Jr., New York, and Benjamin G. Lamme, Pittsburgh; the board also elected three of its own membership as members of the Edison Medal Committee for terms of two years each, namely: Wilfred Sykes, Pittsburgh; W. A. Hall, Lynn, Mass., and G. Faccioli, Pittsfield, Mass.

ARRANGEMENTS COMPLETED FOR CONVENTION OF EDISON COMPANIES.

Program of Convention of Edison Illuminating Companies, New London, Sept. 15 to 18.

All the necessary arrangements, together with the business and entertainment programs, have been completed for the 38th annual convention of the Association of Edison Illuminating Companies. This convention will be held at the Griswold hotel, Eastern Point, New London, Conn., Sept. 15 to 18, inclusive. As this is the first convention of the association in three years it is looked forward to with considerable interest.

As in previous years, the business program has been divided into five sessions, Tuesday morning and evening, Wednesday morning and evening and Thursday morning. In addition to the reports of the various committees, four papers will be presented for consideration and discussion, two of which will be by representatives of the manufacturing interests on timely subjects. The other two subjects are of vital importance to the association at this particular time, namely: "A Symposium of Lamp Renewal Practice" and "The Labor Situation." Further, there will be two addresses by men of high standing, as follows: "Lessons of the War" and "Fuel, with Special Reference to Pulverized Coal and Coal Oil."

An elaborate entertainment program has also been arranged. The location selected for the convention offers unusual opportunities for sports and outings of all sorts and in addition a naval exhibition is planned. Golf and putting contests, archery, croquet, tennis and trap shooting are as usual a part of the program and attractive prizes have been secured for the winners. An informal banquet will be held at the close of the meeting.

For the accommodation of the western members, Godfrey H. Atkin, Electric Storage Battery Co., Marquette building, Chicago, will assist in arranging any details of transportation.

Requests for reservations should be made without delay to Herbert W. Moss, assistant secretary of the association, 39 Boylston street, Boston, Mass.

INSPECTORS' CONVENTION TO OFFER MANY ATTRACTIONS.

Visits to Turners Falls Development One of the Many Features.

Arrangements are being rapidly completed for the reconstruction convention of the National Association of Electrical Inspectors to be held in Springfield, Mass., Oct. 13 and 14. Extra efforts are being exerted to make this the most successful convention ever held by the association and a program of unusual interest is being arranged. In addition, the city of Springfield offers many attractions to convention visitors, which assures a large attendance. In order to illustrate these local attractions the association is sending out an illustrated folder showing views of Springfield and the surrounding country and describing the municipal auditorium, where the convention is to be held.

Another feature which promises to add to the interest of the convention is contained in a letter from George W. Lawrence, president of the Turners Falls

Power & Electric Co. The stations of this company and its system are objects of great interest to electrical men and in his letter Mr. Lawrence cordially invites all attendants at the convention to visit those located in the vicinity of Springfield. Representatives of the company will be in attendance at the convention, and will provide automobiles and guides to all who wish to visit this development. That such provision may be adequate those who intend to make this visit should communicate as soon as possible with Milton S. Nettleton, 98 Hobart street, New Haven, Conn., chairman of the association's entertainment committee.

POPULAR ATTENDANCE AT I. E. S. CONVENTION SOUGHT.

Public as Well as the Trade to Be Welcomed to All Sessions of Illuminating Engineering Society.

Local attendance at the 1919 convention of the Illuminating Engineering Society at Chicago Oct. 21-24 will be stimulated in several ways. The Chicago Electrical Trades Exposition which will be in progress at that time will afford one excellent means of getting convention advertising to the public. For this purpose colored posters are being prepared for exhibition at the electrical exposition calling attention to the fact that the sessions are open to the public and offering suggestions as to where programs can conveniently be obtained. These posters will be displayed in many parts of the show.

The Chicago section of the Illuminating Engineering Society will put on an active membership drive just before the convention. This too is expected to have its effect on the local attendance.

NATIONAL FOREIGN TRADE CONVENTION TO MEET IN SAN FRANCISCO.

The seventh National Foreign Trade convention will be held in San Francisco, Cal., on May 12-15, 1920. It will be the first of these important conventions to be held on the Pacific Coast, previous conventions having been held at Washington, D. C., New Orleans, St. Louis, Pittsburgh, Cincinnati and Chicago. In deciding on San Francisco for the convention city, the National Foreign Trade Council was influenced by the growing importance of the Pacific Coast in the foreign commerce of the country, and by the enthusiastic support which the Far West has given all previous foreign trade gatherings.

While the convention itself will be held in San

Unique Convention of Household Utilities Manufacturers, Jobbers and Dealers

There was held in Minneapolis, Minn., Aug. 14, 15 and 16, an unique convention. It is the first time in the history of electrical trade that a convention was held of the manufacturers, jobbers, dealers and salesmen.

It was called by the Sterling Electric Co. of Minneapolis and the Kelley Hardware Co. of Duluth.

It was the original idea of Harry Bohn, general manager of the Household Utilities Department of the Sterling Electric Co.

All of the dealers and salesmen handling the Gainaday washing machine, the Ohio-Tuec vacuum cleaner, the Simplex ironing machine, the Ruud automatic water heater and the White portable sewing machine, were invited to the convention.

There were about 200 in attendance.

The salesmen were given an opportunity to present their views, the dealers their views, the jobbers their views, and the manufacturers their views.

It was a highly successful meeting.

The program was carried out as follows:

The manufacturers furnished the statistics on the magnitude of the household utility business and impressed upon the jobbers, dealers and salesmen the necessity of getting very busy and reaping the benefits of the big business which is now at hand.

Among those attending the convention was W. L. Rodgers, president of the Pittsburgh Gage & Supply Co.; J. R. Spencer, sales manager of the same company; H. G. Grosse, president of the American Ironing Machine Co.; C. S. Beardsley, general manager of The United Electric Co.; A. P. Brill, general manager of the Ruud Manufacturing Co.; W. H. Vilett, president of the Sterling Electric Co.; Harry Bohn, general manager of the Household Utilities department of the Sterling Electric Co.; W. N. Hart, general manager of the Kelley Hardware Co.; R. Hilgedick, sales manager of the Household Utilities department of the Kelley Hardware Co.; Fred P. Tosch, president of the Farmers Electro Lighting Corp.; J. P. Hanley, secretary and treasurer of the Farmers Electro Lighting Corp.; G. N. Hollway of the Mason City Electric Co.; P. D. Kline, vice-president and general manager of the Wisconsin-Minnesota Light & Power Co., together with eight managers of their various plants; Guy Bisbee, president of the Fixture Equipment Co., and others from North Dakota, South Dakota, Iowa, Wisconsin and Minnesota.

The convention of household utilities interests briefly reported here will undoubtedly be the forerunner of many similar gatherings, as the pressing need for the interchange of ideas and experiences in this field are obvious. Commenting on the value of such conventions, C. S. Beardsley, general manager of the United Electric Co., says: "It was the most unique and successful convention I have ever had the pleasure of attending. It was unusual in that it included manufacturers, jobbers, dealers and salesmen. It gave us all some new angles on the household utility business and impressed upon all of us the magnitude to which this business has grown."

It is hoped that this will set an example to other manufacturers, jobbers and dealers to get together in these conventions for the reason that there is no doubt it will stimulate the use and sale of electric appliances of all kinds.

Francisco, it will really be a Pacific Coast gathering, and the cities of Seattle, Tacoma, Portland, and Los Angeles will share with San Francisco in the attention of the visiting delegates.

CENTRAL-STATION SALES MANAGERS HOLD INTERESTING CONVENTION.

Getting New Business, Principal Topic of Discussion at Annual Meeting at Association Island.

Over 40 central-station people, including sales managers and representatives of other commercial activities, were present at the Sales Managers' convention at Association Island, Henderson Harbor, New York, Aug. 4, 5 and 6. The program included 15 papers on pertinent and timely subjects relating to new business getting and prompted thorough, extended discussion. This was the first convention since August, 1916, and the resumption of these unique gatherings was welcomed.

A special feature of the program came in the second session, Monday evening, when W. D'A. Ryan, illuminating engineer of the General Electric Co., gave a talk illustrated with lantern slides on "Mazda Searchlights and Intensive Street Lighting with Special Reference to the Saratoga System."

The meetings were held in the new Meeting building, which has been erected by the Association Island Corporation to take the place of a tent formerly used. Acting Chairman J. F. Becker, of the United Electric Light & Power Co. of New York City, presided at the first meeting. The president's chair and table used were the gifts of the Sales Managers' convention of 1916 to the Association Island Corporation.

The program of papers was as follows:

First session, Monday, Aug. 4.—"Expense Accounts," R. S. Hale, superintendent of the Special Research department, The Edison Electric Illuminating Co. of Boston; "Merchandising Central-Station Service," John G. Learned, assistant to the vice-president, Public Service Co. of Northern Illinois, Chicago; "Motor Rules for Central-Station Lines," R. H. Tillman, manager, New Business department, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

Second session, Monday evening, Aug. 4.—"Mazda Searchlights and Intensive Street Lighting with Special Reference to the Saratoga System," W. D'A. Ryan, illuminating engineer of the General Electric Co., Schenectady, N. Y.; "The Incandescent Lamp from the Standpoint of the Manufacturer," S. E. Doane, chief engineer, National Lamp Works of General Electric Co., Cleveland, O.

Third session, Tuesday morning.—"Co-ordination of Central-Station Service with Private Plant Operation," L. R. Wallis, superintendent Sales department, The Edison Electric Illuminating Co., Boston; "Isolated Plant Costs as Influenced by the War," John W. Meyer, assistant commercial manager, Philadelphia Electric Co., Philadelphia; "Comparative Power Sales, an Index to Trade Conditions," H. H. Holding, general power representative, Public Service Electric Co. of New Jersey, Newark, N. J.; "Will Industrial Power Customers Approve Increases in Rates to Compensate for Increase in Operating Costs?" also by Mr. Holding; "Typical Report of a Large Office Building with Hydraulic Elevators," W. H. Whitton, general agent, and H. T. Luscomb, acting commercial engineer, New York Edison Co., New York.

Fourth session, Tuesday evening.—"Advertising by Central Stations—A Review and Analysis of Policies—Recommendations for Improved Practice," L. D. Gibbs, superintendent of Advertising department, The Edison Electric Illuminating Co., Boston; "Merchandising Electrical Appliances," Ernest A. Edkins, general manager of Electric Shops, Commonwealth Edison Co., Chicago; "Some Observations on the Tendency Toward Restriction of Central-Station Merchandising," G. E. Miller, sales manager, Cleveland Electric Illuminating Co., Cleveland, O.

Fifth session, Wednesday morning.—"Merchandising Incandescent Lamps," T. I. Jones, general sales agent, and G. J. Liebman, chief clerk, Sales department, Brooklyn Edison Co., Brooklyn; "Progress in Electric Melting of Non-Ferrous Metals," John D. Noyes, senior sales engineer, Detroit Edison Co., Detroit; an explanation of the work of the educational courses, conducted by the Committee of Education, Commercial Section, N. E. L. A., Fred R. Jenkins, manager, Central Station Institute, Chicago.

Sixth session, Wednesday afternoon.—"Delivery of High Tension Service to Large Consumers," Rawson Collier, operating and sales manager, Georgia Railway & Power Co., Atlanta, Ga.; Question Box discussion.

The following is a list of those present grouped under the companies represented: Cleveland Electric Illuminating Co., Cleveland, O., G. E. Miller, sales manager; Commonwealth Edison Co., Chicago, Ernest A. Edkins, general manager of Electric Shops; Oliver R. Hogue, head-lighting agent, and Fred R. Jenkins, manager, Central-Station Institute; Brooklyn Edison Co., Brooklyn, N. Y., T. I. Jones, sales manager, and G. J. Leibman, chief clerk, Sales department; Public Service Co. of Northern Illinois, Chicago, John G. Learned, assistant to the vice-president; Georgia Railway & Power Co., Atlanta, Ga., Rawson Collier, operating and sales manager; Public Service Co. of New Jersey, Newark, N. J., H. H. Holding, general power representative, and F. D. Pembleton, assistant new business agent; New York & Queens Electric Light & Power Co., New York, Charles A. Barton, general sales agent, and L. J. Montgomery, assistant general sales agent; New York Edison Co., New York., A. A. Pope, assistant general commercial manager; W. H. Whitton, general agent, wholesale; A. Hetz, statistician; Walter Neumuller, assistant to the general commercial manager; C. K. Nichols, general agent, power; H. T. Luscomb, acting commercial engineer; C. N. Lewis, heating engineer, and C. L. Law, manager Bureau of Illuminating Engineering; Detroit Edison Co., Detroit, Miss S. M. Sheridan, sales manager; John D. Noyes, senior sales engineer, and Philip J. Savage, assistant to the general manager; A. H. Touscany, appliance sales, and Miss Florence Norwell; The Edison Electric Illuminating Co. of Boston, L. R. Wallis, superintendent of Sales department; R. S. Hale, superintendent of Special Research department; L. D. Gibbs, superintendent of Advertising department, and C. E. Greenwood, superintendent of Appliance department; Potomac Electric Power Co., Washington, D. C., H. A. Brooks; The United Electric Light & Power Co., New York City, J. F. Becker, sales manager; Drake V. Smith, district sales manager, A. F. Berry, commercial engineer, and S. H. Gillerup, advertising manager; Philadelphia Electric Co., Philadelphia, Joseph D. Israel, district manager; Charles J. Russell, general commercial manager, and John W. Meyer, assistant commercial manager; Consolidated Gas, Electric Light & Power Co. of Baltimore, Md., R. H. Tillman, manager New

Business department; General Electric Co., Schenectady, N. Y., W. D'A. Ryan, illuminating engineer, and H. E. Mahon; National Lamp Works of General Electric Co., Nela Park, Cleveland, S. E. Doane, chief engineer; National Electric Light Association, Commercial Section, New York City, A. Jackson Marshall, executive representative.

The officers of the convention for the ensuing year are: Chairman, T. I. Jones, sales manager, Brooklyn Edison Co., Brooklyn; Miss S. M. Sheridan, sales manager, Detroit, Edison Co., Detroit; R. H. Tillman, manager New Business Department, Consolidated Gas, Electric Light & Power Co., Baltimore, Md..

COMMITTEE ON DEVELOPMENT, A. I. E. E., PRESENTS REPORT.

Board of Directors Approves Recommendations in Principle and Suggests Further Communications Be Considered.

The report of the Committee on Development of the American Institute of Electrical Engineers which has aroused considerable interest in engineering circles was presented to the Board of Directors of the Institute at a meeting held in New York City, Aug. 12, 1919. After the presentation of the report by Calvert Townley, chairman of the committee, the following resolutions were adopted by the board:

Resolved, That the report of the Committee on Development be received, with an expression of hearty appreciation of the valuable services rendered to the Institute by the committee.

Resolved, That the recommendations in the report of the Committee on Development, dated Aug. 12, 1919, be hereby approved in principle and that the president refer the various parts of the report to qualified committees, either existing or special, the president being hereby authorized to appoint such special committees as he deems desirable, with the request that these committees formulate definite plans of procedure with estimates of expense involved, for bringing into effect such changes in present practice as the committees deem desirable; also that these committees give careful consideration to such additional communications as may be received from the membership relating to subjects with which the committees are dealing. These reports to be presented at the October meeting of the board.

Resolved, That the report of the Committee on Development, dated Aug. 12, 1919, be released for publication, with particular reference to the technical press; and that it be published in full in the next issue of the Institute *Proceedings*, with a request to membership that the report be carefully considered and that comments upon it or additional suggestions relating to Institute activities be forwarded promptly to the secretary of the Institute, so that they may be received by him prior to Oct. 1 and be promptly referred for consideration to the various committees and officers concerned with the particular activities to which the communications may relate.

Resolved further, That the Committee on Development be continued, with particular reference to the consideration of the Institute's participation in joint activities with various other engineering and technical organizations, which activities are now under consideration by the Joint Conference Committee of the development committees of several national engineering societies.

The first part of the committee's report reviews briefly, the activities of the committee, since its formation. The Committee on Development was appointed by the president, pursuant to a resolution of the board, in the latter part of 1918. At a meeting on Jan. 10, 1919, the board passed a further resolution authorizing the appointment of an Executive Committee from the membership of the Committee on Development.

This Executive Committee held a meeting on Feb. 4, 1919, and prepared a communication to its section members, dividing the subject to be considered into three major headings, namely:

1. The relation of the institute to its members.
2. The relation of the institute to other engineering organizations.
3. The relation of the institute to the public.

Under each heading a series of questions was set up designed to bring out as full a discussion as possible and to make it clear that it was the duty and privilege of the committee to consider every angle of Institute affairs. This letter in addition to being sent to each member of the Committee on Development was brought to the attention of the membership and the sections in order to encourage suggestions. At a meeting of the Executive Committee on May 8, communications had been received from 16 sections and from a number of individual members. Most of these communications showed clearly that the sections had given the matter earnest and careful study, and realized the opportunity that was being offered and were anxious each to do their part. These communications expressed such a general unanimity of opinion on many of the questions considered as to indicate very clearly the wishes of the great body of the members and incidentally to make the work of compiling the views of the different sections remarkably simple.

A summary of the views presented was prepared and a tentative plan of procedure outlined by the Executive Committee and sent to the section members of the committee on May 13th with the request for further comment and criticism. Several responses to this communication were received. The tentative plan of procedure was very generally endorsed either entirely or with minor modifications.

A third meeting of the Executive Committee was held June 16 and a report to be presented to a meeting of the full committee at the annual convention was prepared, the same being the original tentative plan as modified to meet the criticisms received.

At the Lake Placid convention the meetings of the section delegates and the Development Committee were merged. The president, the Board of Directors, several past-presidents and a few guests were present at this meeting and the entire report was very fully discussed. On the following morning the chairman presented the recommendations to an open session of the convention which adjourned until the evening of the same day and discussed the report at length. The recommendations presented are the result of these proceedings and the committee believes they express the consensus of opinion of the membership at large.

These recommendations as presented are substantially as follows.

Recommendations Affecting "Proceedings."

Concerning the *Proceedings* the committee found an almost unanimous view that it does not seem sufficiently to interest the membership at large, and the suggestions of a remedy cover a wide range of possibilities. The value of the class of papers which

heretofore have been published is appreciated and it is insisted that the high standard should be maintained but it is believed that this view is not inconsistent with a recognition of the rights of 90% or perhaps 95% of the total membership who are concerned with the day to day engineering problems and with the personal side of engineering relationships. It is believed that if the *Proceedings* can be properly expanded that publication will serve better to both bind the present membership closer together and furnish an added incentive for membership. The committee devoted a great deal of time to discussions of this matter but felt that with the recommendations of the various sections and the stenographic report of the Lake Placid meetings to be considered, further study should be given to this matter. They, therefore, submitted the following recommendations, to wit:

Publication.—That the Publication Committee be asked to consider and recommend to the Board improvements in the present plan of publishing the *Proceedings* and the *Transactions* and of printing and distributing copies of institute, section and branch papers.

That in dealing with these questions the Publication Committee consider:

A. Enlarging the editorial and executive publication staff for the purpose of expanding the *Proceedings* to contain additional live matter of interest and value to the membership as a whole without giving less importance to the principal activities of the Institute, *i.e.*, the promotion of the fundamental advance in the art and the encouragement of original investigation in the field of electricity.

B. Publishing all Institute papers and occasional papers of unusual broad general interest and value from sections or from other sources; publishing a set of abstracts of every paper presented to every section so that each month there will be a complete record of this class of Institute activity.

C. Eliminating as far as may be feasible the duplication of expense now incurred by twice publishing the papers heretofore distributed (in both the *Proceedings* and the *Transactions*) but without depriving the membership of the *Transactions* in some form.

D. Publishing discussions in the *Proceedings*.

E. Endeavoring to increase the revenue producing capacity of the *Proceedings* by expanding its advertising policy and if necessary changing its page dimensions.

F. Printing pamphlet copies of some or all section and perhaps branch papers and economizing on the cost of printing Institute and such section and branch papers by limiting their quantity and free distribution while making them available for the membership.

In considering the foregoing summarized recommendations the Publication Committee was asked to examine the stenographic report of the Lake Placid sessions of the Development Committee and of the institute.

Closer Personal Contact Urged.

Another unanimous desire of the membership is for closer contact between the institute officers, prominent engineers and the sections as a means of improving the morale of the organization, stimulating section activities and of interesting the membership at large, particularly the younger members, in institute work. On account of the large number of sections and branches this is not considered practical under present conditions. An alternative is to have more officers and let them be chosen from different parts of the country. If this be done and these officers are to be participants in the management means must be provided to insure their attendance at institute and board meetings. It is believed that these objects can be accomplished by decreasing the number of institute meetings and by holding them in different parts of the country and by paying the expenses of board members when in attendance. If the institute meetings are not to be held in New York it follows that the New York members should organize a section. In order to accomplish these results, the committee made the following recommendations, namely:

Organizations.—(*a*) That a New York Section be organized and conducted on the same lines as existing sections elsewhere.

(*b*) That the present practice of holding some of the institute and directors' meetings in different localities, where local sections are established, be extended, instead of holding nearly all of these meetings in New York as at present. It may be desirable to reduce the frequency of Institute and directors' meetings and hold them every two months or perhaps even less frequently instead of every month as now.

(*c*) That the country be divided into geographical divisions corresponding in number to the number of Institute vice-presidents. If more than six divisions should be thought desirable, they should be established and the number of vice-presidents increased to correspond. In order to allow for the future shifting of membership density and at the same time to escape the necessity of cumbersome constitutional amendments, the number and delimination of geographical divisions should be specified in the by-laws instead of the constitution to provide for ready amendment by the Board of Directors.

(*d*) That one vice-president be selected from each geographical division, the president and managers to be elected from the membership at large as at present.

(*e*) That the institute should pay the traveling and living expenses of the officers and board members when attending Institute meetings.

(*f*) That it be the duty of each vice-president to visit each section in his own division at least once a year, the Institute to pay his traveling and living expenses for such visits. Of course it would also be desirable if the vice-presidents could exchange visits.

(*g*) That the vice-presidents' term of office be lengthened from one year to two years and the constitutional inhibition against the election of a vice-president as manager be removed. Provide against too extended tenure of office by a constitutional provision that except in the case of a manager or a vice-president, who may be elected president, no member may continuously hold office longer than six years.

Activities.—(*a*) That committee work be decentralized as far as it may be found feasible and desirable by substituting section committees for Institute committees. Appoint a general committee to study this question and make recommendations.

(*b*) That more high grade papers of general engineering interest be presented.

(*c*) That a committee be created in each section charged with the duty of assigning to the younger members specific participation in designated meetings by the preparation of papers, discussion or otherwise. It is hoped by this means and by the appointment of a reasonable number of the younger men to the larger committee membership caused by decentralization, that the interest of the younger men will be stimulated and their loyalty increased.

Encourage Participation in Public Affairs.

It is recognized that engineers do not participate as actively or as prominently in public affairs as they should and that both the public welfare and their own individual advancement would be promoted if this condition could be rectified. Two general reasons are believed to be responsible for this, one a lack of any general organization of engineers which would facilitate such co-operation, and second, too great technical specialization in the engineering curricula of technical schools and colleges.

The first of these reasons was very generally brought up in one form or another by the sections and although it is recognized that a corrective can be applied only by co-operation with other engineering bodies, it was felt that a constructive step would be taken by adopting a skeleton plan for co-operation and then appoint conferees to discuss the matter with other societies. With this object in mind, the committee recommended:

Local Federation.—(*a*) That a comprehensive but flexible uniform outline for the federation of local engineering bodies be prepared, taking advantage of the experience already gained by existing affiliations.

(*b*) That we use our endeavors to have the other national societies establish and support local sections along

lines similar to ours but do not confine local federations to such branches, rather planning to include all the worthy engineering bodies.

(*c*) That wherever such federations can be organized there be established under an appropriate name a federated local council of engineers to be made up of a properly apportioned number of representatives from the different locals.

National Council.—(*a*) That there be established a direct touch between each local federated council and a National Engineering Council composed of delegates from as many national engineering societies as are willing and worthy to participate.

(*b*) That through the medium of the national and the local federated councils there be perfected a working arrangement for engineering co-operation in all public affairs where such is desirable.

Engineering Congress.—That there be inaugurated the custom of periodically holding an engineering congress, the delegates to which should be selected from all parts of the country under a plan to be developed for suitable representation, this congress to consider and take action on such matters of general interest to engineers and to the public as may merit its attention and as have been previously advertised, for a sufficient length of time, to permit locals everywhere to give them consideration and when possible to send instructed delegates.

The second reason, although of great importance, has not been generally considered. It was, however, the unanimous view of the members attending the convention that this matter should receive early and thorough consideration by the Institute, and the following preamble and resolution was there presented and adopted:

As the individual engineer cannot look for greater public recognition or individual advancement than his training and fitness warrant;

And, in the belief that the bigger development of the profession consists in broader social and public service by publicly-minded engineers;

Recognizing that on the one hand young engineers are employed for too long a period at work which does not stress their capabilities and, on the other, that the demands of industry for ever-increasing numbers of technicians must be supplied;

And having in mind the excellent precedents established by the medical and legal professions;

This committee would welcome the establishment at the earliest date practicable of a normal six years' collegiate course in engineering, two years of which at the least should be devoted to training in the humane arts and sciences including, for example, political science, economics, history and general letters, the last four years being devoted to sound training in the sciences and in only the fundamentals of diversified engineering.

With or prior to such a development we would endorse a program for the marked extension of vocational training in the industrial centers in order that the needs of industry may be met.

To the accomplishment of these ends this committee requests the appointment of representatives to serve on a joint committee of engineering organizations to promote such a national educational program as shall provide for the future necessities of the engineering profession consistent with the needs of society.

A motion has also been adopted that a committee be appointed to confer with the representatives of the student branches and recommend what if any changes should be made in relationship of the branches to the institute and to development in order that this very important part of institute activities should have full consideration and be given the attention which it merits.

Although the board's resolution did not specifically instruct the Development Committee to confer with similar committees from the other national engineering societies, the chairman was informally advised that where such conferences could expedite and help to crystallize the viewpoint of the several organizations concerned without committing the institute to any line of action they would be desirable. Responding, therefore, to a suggestion from the Development Committee of the American Institute of Mining and Metallurgical Engineers and to an invitation from a similar committee from the American Society of Mechanical Engineers, Messrs. Scott, Robinson and the chairman, conferred with representatives of these societies and also of the American Society of Civil Engineers, and the discussions are in progress relative to joint action by these societies. These discussions had not proceeded far enough to indicate what if any recommendations the several governing bodies may be agreed upon but the committee reported progress and stated that the spirit of co-operation was manifested by the other conferees.

STRONG FINANCIAL POSITION OF MARCONI WIRELESS TELEGRAPH CO.

The report of the directors issued in London at the end of July shows that for the year ended December, 1918, the net profit was $2,989,692, and adding to this the balance brought in from 1917 there stands to credit of profit and loss account $4,873,494. This is dealt with thus:

Dividend on preference shares 22% for the year	$ 275,000
Dividend on ordinary shares 25% for the year	$1,529,560
Put to general reserve (making it $6,250,000)	$ 750,000
Carried forward to 1919	$2,318,934

The directors stated that the above figures did not include anything in respect of its claims arising out of the war or for services rendered during the war as settlements had not been arrived at with government departments in respect of these. Since then the courts have completed the hearing of the company's claim for $35,000,000 in connection with the abandonment of the Imperial Wireless chain scheme, and have awarded between $2,500,000 and $3,000,000. The Marconi Wireless Co. holds shares in associated companies and patents which appear at the cost price in the balance sheet, *i.e.*, $6,825,547. The par value of the shares now stands at $11,729,828 exclusive of shares which have no capital denomination.

The issued capital of the company is $7,368,240 of which $1,250,000 is in preference and the balance in common stock.

RADIO STATIONS TO KEEP IN TOUCH WITH AIRPLANES.

Propose to Erect Chain of Stations Across the Continent as Aids to Aircraft.

Plans are announced by the American Flying Club for the construction of a chain of radio stations across the continent so that airplanes may be in communication with them at 30-minute intervals. The club will work in conjunction with the Government, which has already started a series of radio stations in connection with the airplane mail-delivery service.

DATES FOR IOWA STATE CONVENTION ANNOUNCED.

The date for the annual convention of the Iowa State Association of Electrical Contractors and Dealers has been set for Sept. 22 and 23. The meeting will take place in Sioux City, Iowa. F. Bernick, Jr., of Oskaloosa, Iowa, is state secretary.

Commercial Practice

Sales in Small Towns—Electric Makes 300-Mile Journey School for Salesmen Opened — Aerial Delivery of Lamps

PERCENTAGE OF SALES IN SMALL TOWNS SHOWN.

Public Service Co. Finds 95% of Sales Are Made in Larger Communities.

Some interesting facts regarding the influence of local stores are brought out in a recent article in the "Sales Bulletin" of the Public Service Co. of Northern Illinois. Out of a total of over 88,000 customers to whom the company is supplying electric service, more than 31,000, or over 35%, live in small towns in which the company does not maintain an office or store. Referring to the sales report it is found that 95% of the company's appliance sales were made in the towns in which an office is established. In other words, only 5% of the total appliance sales are made to the 31,000 or 35% of its customers living outside the towns where offices are located.

However, the amount of business in these towns is not sufficient to warrant the establishment of a store there and these figures were published to point out to the company's salesmen and its employes the opportunities that exist in these towns and to encourage them to get out after the business in the smaller communities.

The company has adopted several methods of reaching this trade, one of the most successful being its "income boosting" plan. According to this plan any of its employes in these districts may sell appliances for the company and receives a commission on the sale in addition to his regular salary. The results of this plan have been very satisfactory, not only for the company but for the employes, many of whom receive substantial checks every month for their extra efforts in this way. Another plan that has been adopted is to enclose return cards describing the appliances with the customers' bills.

LONG VACATION TRIP MADE IN ELECTRIC VEHICLE.

Recent Journey from Chicago to Cambridge, Wis., Made by Four Ladies.

The adaptability of the electric passenger vehicle for long trips was demonstrated by a 300-mile journey made in one recently. The unique feature of this trip was the fact that it was made by four ladies, alone, without any preliminary arrangements being made other than to plan where charging stops should be made. The route covered was from Chicago to Cambridge, Wis., and return, after a two weeks' vacation, via Rockford, Ill. The car was driven by Miss Jessie C. Stevens of Chicago.

The electric was equipped with a 42-cell, 11-plate battery. The following log of the journey is taken from an article in the *Round Table* of the Commonwealth Edison Co., Chicago.

First Day.

10 a. m.—Left Magnetic Motors Corporation, 25th street and Calumet avenue.

12 a. m.—Arrived Becker's garage, Highland Park, Ill. Car charged.

2 p. m.—Left Becker's garage.

3 p. m.—Arrived Colwell's garage, Waukegan, Ill. Car charged.

7 p. m.—Left Colwell's garage.

10:30 p. m.—Arrived Wilson's garage, Milwaukee, Wis. Car charged.

Second Day.

11 a. m.—Left Wilson's garage.

12:15 p. m.—Arrived Waukesha, Wis.

12:45 p. m.—Car charged by Waukesha Auto Co.

3:45 p. m.—Left Waukesha Auto Co.

5:35 p. m.—Stopped at Helenville, Wis., for tea.

8:45 p. m.—Reached Cambridge garage, Cambridge, Wis., destination. Car charged.

Return—First Day.

9 a. m.—Left Ingleside, Wis.

12 m.—Arrived Janesville Contracting Co., Janesville, Wis. Car charged.

Second Day.

7 a. m.—Left Janesville, Wis.

8:30 a. m.—Arrived Beloit, Wis. New cell put in at Beloit service station.

11:45 a. m.—Left Beloit, Wis.

12:55 p. m.—Arrived at Rockford, Ill. Car charged at Phillip's garage.

7 p. m.—Left Rockford, Ill.

9:45 p. m.—Arrived Marengo, Ill.

Third Day.

7 a. m.—Left Marengo, Ill.

8:55 a. m.—Arrived Elgin, Ill. Car charged by battery service station.

7 p. m.—Left Elgin, Ill.

9:45 p. m.—Arrived Garfield Park, Chicago.

11 p. m.—Arrived 106th and Prospect avenue, Chicago, over 10 miles more power left in the battery.

The party is perfectly satisfied with the performance of the electric during the entire trip and enjoyed it even more than had a gas car been used.

SCHOOL FOR SECURITY SALESMEN.

Doherty Organization Opening Salesman's Course.

The Doherty Organization is to open a school for the training of young men as salesmen of securities. The school will be in charge of Leonhard Felix Fuld, who has had a wide experience in service instruction. He was with the United States Bureau of Education for several years and published a book for the government on education. For eleven years he had charge of the personnel for the City of New York.

The school for salesmen will probably open about the first of September. All of the details have not

been worked out as yet but it is planned to offer young men desiring to enter this field of activity an opportunity to enter the school. School hours will probably be arranged so as not to conflict with regular office hours.

The opening of this school is another extension of the idea that has characterized the success of Henry L. Doherty and the Doherty Organization in the business world. The school will be well advertised and it is expected that there will be a large number of applicants for attendance. The length of the course has not been decided nor the hours that the school will be open.

AERIAL MAIL DELIVERY OF MAZDA LAMPS.

Republic Electric Co., Cleveland, Receives Order by Air from New York.

A package containing the latest development in lamp construction, the Edison white Mazda lamp, addressed to Louis Griesser, president of the Republic Electric Co., Cleveland, Ohio, was recently shipped by airplane from Belmont field, New York City. Leaving at 5:00 o'clock in the morning, it was delivered through the regular channels and in good condition at 2:00 o'clock in the afternoon.

This is understood to be the first electric lamp delivery made to a customer by Aerial Mail Service, but Mr. Ruehl, in charge of the transportation department of the Edison Lamp Works at Harrison, states that from now on aerial mail delivery service in emergencies will be a regular part of shipping service wherever the Government makes provision for such delivery.

On the present schedule, planes leaving Belmont Field, New York, at 5:00 a. m. are due to arrive in Cleveland at 9:30 a. m., connecting with planes for Indiana, Kentucky, Michigan and Ohio. Other mails will be taken to Chicago for distribution, connecting with planes for all western states, British Columbia and the northwestern territory of Canada.

When Heller field at Newark, N. J., the largest landing field in the east for Aerial Mail Service, is complete, all aerial mail will be sent direct from Newark.

Packages sent by this service are necessarily limited in size to 30 in. in length and girth.

CITIES SERVICE CO. OPENS CONSUMERS' OWNERSHIP BRANCH.

Plans Being Developed to Interest Consumers in Securities of Company and Subsidiaries.

The bond department of the Cities Service Co. of New York has opened a branch that will be devoted to the sale of securities of that company and its subsidiaries to its consumers. The work of this branch according to *Sparks*, the publication of the Toledo Railway & Light Co., one of the subsidiaries, will be handled by L. F. Wiegand of the bond department.

For some time the Doherty organization has been considering the opening of this branch, realizing the opportunities and advantages of the sale of securities to the consumers of the products of its subsidiaries. The new branch will inaugurate an active campaign along these lines, and one of its main purposes will be the development and maintenance of good will between the consumers and the public utilities.

By becoming interested financially in the public utilities from which they purchase gas, light or street car service, the consumers are in a better position to understand the problems and financial requirements of the companies in their localities. The usual difficulties encountered in the maintenance of fair relations with the public are materially lessened. Practically all the advantages of public ownership are attained through such a partnership without the sacrifice of the greater advantages of private ownership that occurs when public ownership is substituted for private ownership.

Details of the operation of the Consumers' Ownership Branch will be announced in the near future.

BRITISH MUNICIPALITY TURNS TO ELECTRIC TRUCKS.

A report recently issued by the engineer of the Hackney Borough Council is most strongly in favor of adopting the electric truck for handling the municipality's refuse.

The report summarizes in a lucid way the advantages of mechanically propelled vehicles, and as his conclusions may be helpful to other engineers, we reproduce them. They are as follows:—(1) That removal of house refuse by mechanically propelled vehicles is advantageous and more economical than horse-drawn vehicles when expedition in collection is obtainable. (2) That the conditions of working and the general arrangements of collection in the districts visited are not comparable with the conditions existing at the present time in Hackney. (3) That to secure economy by the use of mechanically propelled vehicles for house refuse collection it is essential that, as far as practicable, a continuous collection be made, and that "waiting time" be entirely avoided during the hours of working. (4) That "electric" vehicles are suitable for the work if the conditions of working warrants the use of mechanically propelled vehicles. (5) That "electric" vehicles are easy to manipulate and work and are economical in working, but more costly to purchase than other kinds of mechanically-propelled vehicles. (6) That to secure economy and efficiency by the use of mechanically propelled vehicles in Hackney, the "calling at" and the "entry" of the workmen into houses and private premises after knocking or ringing and waiting for entry must be abandoned. (7) That more frequent collections should be inaugurated and the occupiers of all premises, as is the case in all districts visited, be required to place the refuse in suitable receptacles, on the footways or in accessible situations, at times to be specified. (8) That it is expedient that a trial of the use of mechanically-propelled vehicles in this district should be undertaken by the purchase of three or four vehicles before any general scheme is adopted, such vehicles being used in different areas of the borough with a view to obtaining reliable data of cost under such improved conditions of working as can be adopted in the borough.

In Hackney at present there are thirty-four horse-drawn vehicles engaged on the work daily, and about 33,000 tons of refuse are annually collected, and the Public Health Committee believes that by an improved system of collection and the use of mechanically-propelled vehicles, a considerable saving per year can be effected.

Four trucks are to be purchased, two of 2½ and two of 3½-ton capacity.

Operating Practice

Installation of Electrically Operated Valves — Insulator Maintenance—Cable Coverings—Water Turbine Blading

COMPLETE SYSTEM OF ELECTRICALLY OPERATED STEAM VALVES.

Interesting Installation by Rochester Railway & Light Co.

The Rochester Railway & Light Co. is installing a very complete system of remote controlled steam valves in turbine and boiler room at its station No. 3. The aim of the installation is to add to the safety and flexibility of the station by enabling the important valves to be operated from a safe distance.

The original layout consisted of the proposed operation of 17 valves with the "Dean" control system. These consist of three 14-in. valves above the boilers in the old boiler house, eight boiler and two main steam line valves in the new boiler house, and four stations in the engine room, controlling steam to turbines Nos. 1, 2, 3 and 4. The steam valve on the line to turbine No. 4, while located in the new boiler house, is entirely controlled from the engine room.

To this layout for the control of 17 valves has been added recently a similar control of the Chapman valves used on boilers Nos. 12 and 21, the latest installed, and one turbine No. 5, just recently tested out and now running on the line.

All valves on lines supplying steam to the several horizontal turbines, called turbines Nos. 1, 2, 3, 4 and 5, are entirely controlled in the turbine room. These valves are in or near the upper galleries. The hold-in switches are located on the galleries near the valves, but the Dean controllers are operated from the turbine floor. Each of the turbines has an individual controller placed near the machine for close and handy operation; each has also a remote controller placed in the engine room opposite to and farthest from the machine, the steam valve of which might require emergency control. For example, on the east wall of the engine room is mounted a steel plate, on the face of which are installed the three controllers remotely operating the valves of steam lines, to turbines 1, 2 and 3. These controllers are lettered respectively Turbine 1, Turbine 2, Turbine 3, and represent in miniature the machines themselves, and the mounting plate is painted with a red band to indicate the walls and west part of engine room. In addition there is mounted on this panel—in miniature facsimile—the steam lines, with their valves, which supply steam to the turbines. The miniature valves and pipes connecting the controllers, represent the actual steam lines connecting the turbines. This system will be more fully covered later in describing the remote control panel boards for the boiler room live steam system.

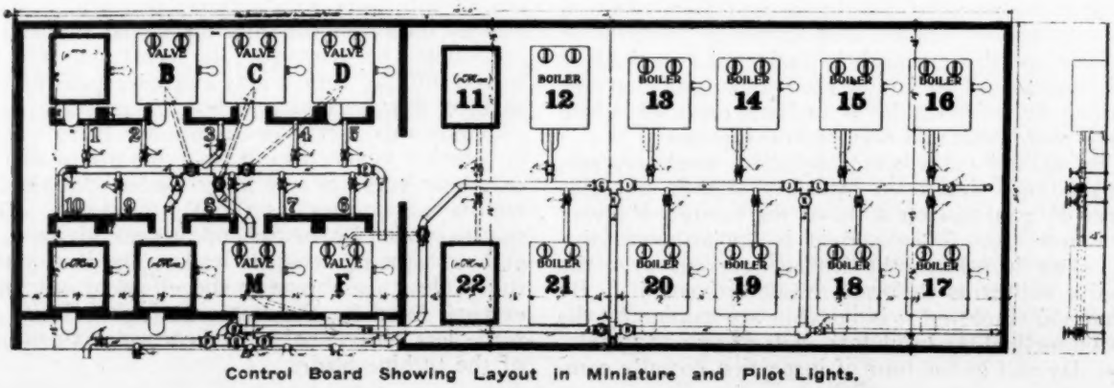
Below is a plan of the principal controller panel boards at which are operated at present 15 valves with a capacity for mounting five additional controllers There are two similar panel boards, one located in the anteroom of Station 3 office, the other located in a steel and brick penthouse especially built for it on the north wall of the boiler house and just outside the north doorway of the boiler room. They consist of steel plates 3 ft. 4 in. high by 10 ft. long supported on steel angle legs and framework.

The face of the board, also the controllers and conduits on the board, are painted black; a red band is used to indicate the building walls; also to indicate the ten B. and W. boilers of the old boiler house. The controllers mounted in that part representing the new boiler house indicate in miniature each the exact boiler the valve of which is operated by the controller so mounted.

Ten Dean controllers represent boilers 12 to 21, inclusive. They are so marked and operate the valves of the live steam connections from these same boilers to the main steam headers supplying the turbines.

The ten B. & W. boilers of the old boiler house do not have electrical control of their individual steam valves, but five valves of the main steam headers are electrically controlled, as indicated on these panel boards and in the same manner as the boiler steam valves above mentioned. The controllers operating these valves are marked as Valve B—C—D—M—F, thus relating each controller to the valve it will operate.

In addition to the controllers representing valves or boilers, the valves of which they operate, the entire live steam piping system of the boiler room also is represented in miniature by small piping with all



Control Board Showing Layout in Miniature and Pilot Lights.

fittings, valves, etc., mounted at about one-twentieth true size. Eight-inch steam lines are represented by one-eighth inch pipe, 10 and 12-in. lines by ¼-in. pipe; 14 and 16-in. lines by ⅜-in. pipe. A small wheel disc on a stem, threaded and fitted into a tee, makes a "Dummy" valve to indicate each steam valve.

This miniature piping is true to the actual station steam pipe layout generally, except in a few places, where the details are shown more directly and in diagrammatic form. For example—all the boilers have live steam connections with large U bends—so they are represented on the panel boards as straight connections to the main steam header.

A color scheme for lettering or numbering valves, controllers and other apparatus is also being used. As each controller box is given the name and number of the boiler whose valve it operates, so the faces of the related hold-in-switch box, enclosed rheostat and fuse boxes, and face plate of the valve motor unit are each lettered with the same name and number, in white upon the black finish of the apparatus. Each valve which is electrically operated will have its key number or letter painted on the body in white upon a red ground, and the "dummy" of this valve located on the panel boards will have its wheel disc painted red with the same letter or number in white upon it.

Each valve which is not electrically operated will have its key letter or number painted on the body of the valve in white upon a black ground, and the "dummy" of it located on the panel boards will have its wheel disc painted a black ground color with the number or letter in white upon it.

The miniature valves by their color show plainly which ones are electrically operated; and the signal lamps at the top of each controller show by their color, red or green, at all times whether the valve which it operates is open or closed.

The entire system is before one like a map with its operating status indicated in detail, thus giving the operators not only a knowledge of the existing status, but also allowing the operation of any valve in any manner desired in the shortest time, under normal or emergency conditions.

METHOD OF MAINTAINING INSULATORS EMPLOYED IN GEORGIA.

Inspection Segregated from Making Repairs Improves Routine.

The Georgia Railway and Power Co. operates a very extensive system of transmission lines. Experience has proved to this company that it is far better to keep their high-potential lines in good condition than to allow them to deteriorate and then overhaul them. It is well known that insulators deteriorate with time and this company has adopted a method by which insulators can be watched and units that are becoming defective can be located and replaced before causing shutdowns and service interruptions.

The method of detecting defective insulators employed is that developed by Mr. Johnson, superintendent of transmission wires of the Georgia Railway and Power Co. This method is applicable to live lines, since it utilizes the leakage current over the defective insulators to locate the defective units. By the method employed it is possible to examine by the Johnson method the insulators on as many as 125 poles in one day and in one tour of inspection recently completed by the company 65 miles of line were inspected between June 30 and July 25.

In making these tours of inspection or search for insulators that are becoming defective the only equipment employed is the "buzz" stick used for measuring the leakage current. When an insulator is found to be defective it is painted with a daub of red paint and a report is sent in. A gang following the inspectors changes the insulators. This method has been found most satisfactory.

THREE-PART PROTECTIVE COVERING FOR CABLE SHEATHS.

Cement, Clay and Cheesecloth Recommended for Cable Covering.

Probably the best way, and always the cheapest way, to protect cables in manholes from damage from an external source is to wrap the sheath on outside of the cable with some form of covering or protective shield. In adopting a covering it is important that it serve three functions: It should radiate readily the heat which is generated within the cable; it should protect the cable from mechanical injury; it should protect the cable from heat caused by a fire in the manhole or by the burning up of adjacent cables.

The following is a good way of covering cables, and has proven most satisfactory and inexpensive in comparison to other coverings.

First, wrap the cable with a layer of cheese cloth made up in lengths of 4 in. wide. On the top of this a coating of cement and sand is plastered from ½ to ⅝ in. in thickness, and on this wrap another strip of cheese cloth. Ordinary bank sand in which there is some loam is used for the mixture, and it is mixed in 2 to 1 proportion with very little water to the consistency of very stiff mud. In winding this on with cheese cloth as above mentioned, the cloth is pulled tight, thus forcing the grout to ooze out between the meshes of the cloth, and this provides a finished outer surface for the cable. It is not considered advisable to go over this with a coating of neat cement, as this provides too fine a covering and cracks will result.

It is evident that a cement coating of this thickness will perfectly protect the cable from any mechanical injury, and it is a fact that it will protect it from a very intense heat from without.

LEAD COATING TO PROLONG LIFE OF TURBINE BLADES.

It is a matter of experience, and one which has been discussed from time to time, that if attempts are made to clean iron surfaces that are covered with lead by means of the sand blast, that the lead covering cannot be removed. It seems that the lead is forced into the depressions and interstices of the iron surface, thus becoming tightly imbedded.

Upon this fact experiments are being carried on by which it is aimed to increase the life of the blading or water turbines operating under high head with high-velocity water, as the Pelton wheel. The lead can be applied by the Schoop process, giving a smooth and uniform covering of lead to the iron surface of the blades. In this way the effect of silt and sand carried down by the water at high velocity can be made less objectionable in wearing away the surface of the turbine blades.

Contracting-Construction

Suggestions for Wiring Electric Ranges—Important Factors in Repair Business — House Wiring on Installment Plan

PROPER WIRING INSTALLATIONS FOR ELECTRIC RANGES.

Abstract of Wiring Specifications Contained in Electric Range Handbook.

With the rapidly growing demand for electric ranges the necessity of suitable and adequate wiring installations for them is becoming more important. For this reason the Society for Electric Development, Inc., has devoted a chapter of its Electric Range Handbook to the subject of wiring specifications which contains many valuable suggestions and ideas on such work. These specifications are not intended to give detailed instructions on the methods to be used but to furnish an outline of certain general arrangements and requirements which should be followed. Each job presents a different problem which must be solved by the man on the ground and the completed job made to conform with the requirements given and the code rules.

Service wires from the outlet to the switch should be three-wire, 110-220 volts and No. 8 wire should be

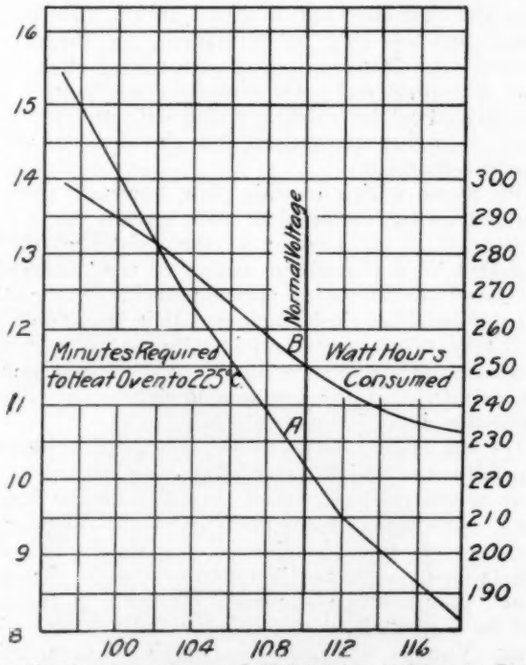


Chart Showing Importance of Maintaining Voltage in Electric Range Operation.

the minimum size used. In new buildings the exact wire size will be largely determined by the ultimate load to be installed. At present the code requires that mains feeding more than one range be large enough to supply the total load of all the ranges at one time. This ruling, however, is often modified by local authorities. However it is well to provide for the maximum requirements in the original installation rather than to change later.

In installing a range in an old residence using electric service a new meter location and switch should be installed and the present lighting mains connected to it, unless the present wiring has sufficient capacity to take care of the additional load. In apartment buildings the existing meter locations should be used if possible and a new circuit installed to the building outlet.

The service switch in a range installation should be a three-pole, single-throw, fused knife switch of 60-amp. capacity or larger. The range circuit should be three-wire No. 8 or larger depending on the size of the installation and the distance from the meter to the load. To assist in determining the proper size of wire the following table may be used:

WIRING TABLE.

TWO PER CENT DROP.

Load, watts.	Distance in feet for 110-220-volt, three-wire circuits. No. 8, 35 amp.	No. 6, 50 amp.	No. 4, 70 amp.	No. 2, 90 amp.	No. 1, 70 amp.
1,000.....	375				
1,500.....	250				
2,000.....	185	295			
2,500.....	145	235			
3,000.....	125	198	316		
3,500.....	105	170	270		
4,000.....	93	148	236		
4,500.....	83	132	213		
5,000.....	76	118	188	300	
5,500.....	68	108	172	273	
6,000.....	62	99	158	250	312
6,500.....	58	92	145	231	289
7,000.....	54	85	135	215	268
7,500.....	50	79	126	200	250
8,000.....		74	118	187	234
9,000.....		66	105	166	208
10,000.....		59	95	150	187
12,000.....			79	125	156
15,000.....				100	125
20,000.....					94

The minimum size wire, No. 8, may at first appear too large for many installations but it has been found desirable to recommend this size as it will permit installing a larger range without changing the wiring.

In addition to the service switch, a master switch, preferably of the enclosed safety type should be installed at a point within easy access of the range. Where water heaters and ranges are supplied from the same circuit this same switch must be arranged or another installed to provide for it.

The frame of the range and all conduit used should be permanently and effectively grounded in accordance with the code requirements. In addition the neutral wire of three-wire circuits should be grounded at the main switch and at the range.

It has been assumed that the range manufacturer has balanced the heating circuits connected to each leg of a three-wire range. If this is not the case the units must be reconnected of the size of wire, switches and fuses increased to amply provide for the maximum current on the more heavily loaded side.

The importance of maintaining voltage, which is largely dependent upon the wire size is shown in the accompanying chart. From this chart it can be seen

that not only does it require a longer time to bring the range oven to the desired temperature when the voltage is low but the actual consumption is greater than when the proper voltage is maintained. It is evident, therefore, that the selecting of wires of a proper size is of utmost importance.

IMPORTANT FACTORS IN CONDUCT OF SUCCESSFUL REPAIR BUSINESS.

Papers at Repair and Sale of Used Apparatus Section Meeting Brought Out Interesting Discussion.

In the lively discussion that took place following the presentation of the papers at the meeting of the Repair and Sale of Used Apparatus Section of the National Association of Electrical Contractors and Dealers recently, many interesting and important factors in the conduct of a successful repair business were brought out.

In quoting prices, for example, the desirability of taking all jobs, except those on which there can be no question as to the extent of the necessary repairs, on a time and material basis was shown. It was pointed out that the average customer is concerned more in having the damaged or defective apparatus put in first class condition again than in having the particular defect that caused the breakdown remedied. To illustrate, he does not want to have a field rewound and have another breakdown occur in a few months due to a defective bearing that could and should have been replaced at the same time. As the extent of such repairs can not be ascertained without a very thorough inspection and test that it is often impossible to make until the machine is being overhauled, the cost of putting it back in good condition can not be determined until that time.

Along this line the fallacy of estimating the cost of making the necessary repairs roughly at first sight or over the telephone was also shown. Such a figure, no matter how carefully the estimator explains its inaccuracy, is always accepted by the customer as being the maximum price and if the cost of the repairs is higher he will be dissatisfied. On the other hand, if the estimate is too high it will tend to scare the customer into the purchase of a new machine.

The advisability of conducting a department for repairing autostarters, ignition systems and other electrical equipment used on automobiles in conjunction with the regular repair business was also fully discussed. The consensus of opinion among those present seemed to be that such a department could be profitably conducted if the volume of business was sufficient. However, such work can be properly done only by specialists in that line and these men are seldom capable of doing regular repair work in the shop. For this reason the volume of auto repair work handled must be enough to employ all their time or a large portion of their unoccupied time will be lost.

Handling presents another important problem, especially with the larger machines and apparatus. Very often the cost of getting such machines to the repair shop and back in place at the customer's premises again is much higher than the cost of doing the actual repair work on them. It is evident, therefore, that the relation of the cost of a job to the handling cost varies in practically every job and should be figured separately in billing.

In order to prevent complications when there is more than one job from the same customer in the shop at the same time, many of those present give every piece of work a shop or job number by which it is identified in the shop. This method also assists the office force in keeping its records of the various jobs.

Another important item is in keeping the time on jobs correctly. This is especially important in a repair shop inasmuch as nearly all the work is done on a time and material basis. If the keeping of labor records is left entirely to the workmen, discrepancies are sure to creep in which will penalize one job and make the charges on another too small. The majority of companies overcome this difficulty by using a time clock on which the men register the time when they start and leave any job.

The proportionate labor charges for work done in the shop and on the customer's premises was also discussed. Due to the fact that work done on the customer's premises presents difficulties and inconveniences not encountered in the shop and as such work is usually of the emergency order, the majority of the members were of the opinion that it should be charged for at a higher rate than work done in the shop. In addition to this higher rate the time required for getting to the work and back and transportation expenses should also be charged.

GOODWIN ENCOURAGES PART-PAYMENT PLAN FOR HOUSE WIRING.

Would Prefer House Wiring on Installment Plan to Appliance Sales That Basis.

Many electrical contractors do not care to do old house wiring on the installment or part-payment plan because there is no immediate method of collecting should the customer fail to pay. In the case of removable articles, such as appliances, the dealer can of course take them back, but with wiring such a recourse is impractical. Of course a mechanic's lien can be placed on the building which will interfere with its sale or further mortgaging, but this does not effect an early settlement.

With house wiring on this plan, however, there is an added moral factor that adds greatly to its reliability. It is on account of the existence of this factor that W. L. Goodwin, author of the "Goodwin" plan stated at the recent meeting of the Association of Municipal Electrical Engineers that he would prefer to take this business on installments rather than appliances. His statement in this respect as reported in the *Bulletin* of the Ontario Hydroelectric Power Commission is as follows:

"Of the choice between the selling of appliances on installments and house-wiring on installments, so far as security is concerned, I will take the house-wiring. We know from the experience of over 20 years, in every line of endeavor, that the credit losses on installment sales are less than 1%. As a matter of fact, they average one-quarter of 1% in the case of all the big installment houses throughout the United States. You are selling to what might be regarded as the most unreliable kind of purchaser, the one that has to buy on the installment plan, but there is something about the people of this continent that makes them keep their installment payments as faithfully as they will keep their religion. If you give a man a washing-machine on 60 days' credit, he will beat you right and left, and if you sell it on the installment plan you will have to chase him all over the country. In the case of house-wiring, however, he cannot move it away and it becomes a lien on the building."

New Appliances

Pipe Fittings with Composition Bushings — New Development in Electric Washers — Attractive Lighting Fixture

Adapti Line of Pipe Fittings With Composition Bushings.

A new line of pipe and fittings and composition bushings is being placed on the market by the Adapti Co., Cleveland, Ohio, makers of the "Adapti" line of outlet boxes and similar fittings. These fittings are especially intended for use in protecting the wires in conduit systems where they enter cutout, service and panel boxes. Being of composition, the bushings offer great mechanical and dielectric strength and involve no danger of breakage, as is the case with those made of porcelain.

They are made in all standard sizes, with a standard pipe thread that screws into the fitting itself. They can, therefore, be securely fastened in knockout holes with standard conduit locknuts and are also adaptable for use with standard couplings.

Surf Electric Washing Machine.

Recognizing that the real cleansing action in washing clothes is obtained through thorough agitation of the clothes with soapy water and that rubbing adds nothing to the real cleansing action, a new type washing machine has been developed in which all friction has been disposed with and the foregoing principle applied exclusively. It is known as the "Surf" electric washer and is made by the Surf Manufacturing Co., 518 Grand Ave., Milwaukee, Wis. As shown in the accompanying illustration, this machine operates on the oscillating cylinder principle, but makes use of a new development in this line. In the lower portion of the cylinder is placed a screened, raised bottom plate, the end portions of which are closely perforated, as can be partly seen in the illustration. The cylinder itself has no ribs nor projects to break the flow of the water. Below the bottom plate referred to, there is room for about a pail and a quarter of hot water. The clothes are thrown in on this bottom, the cover closed tightly and tub placed into oscillation. This action causes the tub to tip the clothes back and forth into this water. The water pours through the screened plate and through and over the clothes. The rising of the tub on that side lifts the clothes but drops them again in the next moment, thus meeting a rush of water coming from underneath and thoroughly showering the batch of clothes. It is from this surf-like action of the water that the machine gets its name. The water is forced through the clothes 72 times a minute, thus giving specially thorough mingling of the soapy water with the clothes.

With the exception of parts of the wringer, all of the machine is made of metal, the tub being either of galvanized iron or copper. The machine is made in one size only, having a capacity of 8 sheets, or their equivalent. It has a 12-inch reversible and removable swinging wringer provided with a safety release. All of the driving mechanism is inclosed in an oil-tight case. The drive from the motor is direct through suitable gears and shafts, a safety clutch being placed in the motor shafts to prevent burning out of the motor in case there should be any clogging in the machine. There is no opportunity for the operator to be injured in any moving exposed parts since these are all inclosed or guarded. The framework is of substantial angle iron well braced and is mounted on roller bearing castings. The machine is very simple, both in construction and operation, and is almost noiseless. It is easily controlled by means of a conveniently placed handle which covers the cylinder and another handle for controlling the wringer. A switch starts and stops the motor.

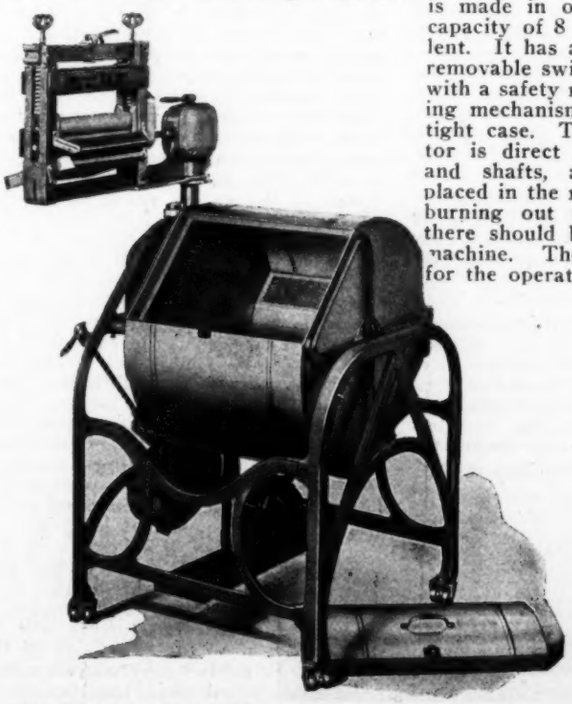
The New E-lite Lighting Fixture.

A new fixture called the E-lite has been produced after careful and exhaustive tests by the Luminous Unit Co., 2615 Washington avenue, St. Louis, Mo. This unit, in the opinion of the company, is destined to become the most popular of all fixtures for home, school and other such places.

The fixture consists of a metal canopy, a white glass reflector 13 in. in diameter, and a white glass or Adam embossed etched cylinder of 6-in. diameter. Contrary to the usual design of such fixtures the lamp is encircled by the cylindrical shade but is exposed at the bottom, thus providing a certain amount of direct illumination. This feature also prevents dust from collecting in the shade and makes it easier to clean.

The unit is aesthetic, utilitarian and attractive—yet economical. It produces a soft tonal illumination and obtains maximum results from the Mazda type-C bulb which is used, and its reflector working in conjunction with the bowl produces an excellent ray distribution and eliminates shadows. It is furnished in both ceiling and chain design in three sizes for use with 75, 100 or 150-watt lamps.

The name E-lite is also significant and was adopted for two reasons; the word itself, E-lite meaning to describe the high quality of the fixture, and the "E" standing for the efficiency of this unit.



The Surf Electric Washer With Tub Opened, to Show Interior Construction.

E-lite Lighting Unit Especially Adapted for Home, School and Similar Uses.

Trade Activities

Belden Co. Erects New Building — Chicago Pneumatic Tool to Remove Headquarters to New York — Literature

The Babcock & Wilcox Co., with main offices at 85 Liberty street, New York City, has removed its Seattle office from the Mutual Life building to Rooms 1914-1917 L. C. Smith building.

Acme Wire Co., New Haven, Conn., announces that due to the increasing volume of its business in the Middle West and the desirability of keeping in closer and more frequent touch with the requirements of its customers it has opened an office in Cleveland, Ohio. Its sales representative is J. T. Crippen, the office address is 521 Guardian building, and the telephone number is Main 2024. The step taken by the Acme company will undoubtedly result in a closer and more effective association with its many friends in the Middle West.

Quigley Furnace Specialties Co., 26 Cortlandt street, New York, has been awarded the contract for the complete equipment for preparing, distributing and burning the fuel to be installed in the Falcon Steel Co.'s new sheet mill at Niles, O. This mill will use powdered coal throughout for firing boilers and furnaces and the power-plant boilers will be powdered-coal fired, using the Quigley compressed-air system for transporting and burning the coal. The pulverized coal will be transported from the milling plant through standard four-inch diameter wrought pipes to furnaces and boilers for various distances, aggregating 800 ft., and will be switched from the main distribution line to a storage bin in the power house for use as required for the boilers.

Crystal Washing Machine Co., Detroit, Mich., is distributing a "Special Merchandising Plan Book" to the trade which explains the assistance offered by this company to its dealers in promoting the sale of Crystal electric washers. This, accordng to indications, will be a particularly fruitful field for the sale of this labor-saving device and for that reason such sales helps as are described in this book should prove especially valuable to the contractor-dealer or central station. The sales helps described are all furnished by the company and consist of striking window displays, newspaper advertisments, in either matrix or electrotype form, demonstration book for the house-to-house salesman, window cards, moving picture slides, complete instructions on the preparation and maintenance of a mailing list, together with two sales letters and an outline of direct-by-mail campaign, and literature for distribution to prospective customers. This plan thoroughly analyzes the field and makes use of every known advertising strategy in leading prospective customers to the dealer's store.

Black & Decker Mfg. Co., Baltimore, has issued a catalog giving a full and illustrated description of electric air compressors, portable electric drills and electric valve grinders. A copy of the catalog will be mailed free upon application.

Youngstown Sheet & Tube Co., Youngstown, Ohio, has commenced the publication of a house organ, the initial number being dated August 15. It is a plant paper of a rather unique type, and its purpose is to promote friendliness, acquaintance and a fellow feeling among the employes of the company. So far as practicable, it will be the work of its own people exclusively. All of the matter including the art work in the first issue was done by men in its works.

Chicago Pneumatic Tool Co. is planning for the removal of its general offices from Chicago to New York. An office building is being erected at 6-8 East 44th street, New York, and it is expected that the building will be ready for occupancy early in 1920, at which time the transfer will be effected. The structure, which is being built by Westinghouse-Church-Kerr Co., is of combination steel, brick and limestone, and will comprise initially ten stories, all to be occupied by the company. The ground floor is to be an attractively designed permanent exhibition room and will contain a display of the many Chicago Pneumatic products, including Boyer pneumatic hammers, Little Giant pneumatic and electric tools, rock and coal drills, air compressors, etc. In conjunction, a completely equipped service station will be maintained. The company maintains six American plants and 26 sales and service branches, the operation of which will be more economically directed from New York. A sales and service organization more extensive than at present will be continued in Chicago.

Dantzig, Pfeiffer & Ritt announce their organization as a firm of consulting mathematicians, with offices located at 500 West 116th street, New York City. This firm undertakes to handle all problems arising in industry for the solution of which the knowledge of a mathematical specialist may be necessary. Each of the members of the firm has been privately engaged for some time in work of this nature, in addition to his other professional activities, and it was at the suggestion of clients that the decision was made to set up a consulting service which would extend to the industrial world the resources of modern pure and applied mathematics. Dr. Dantzig is a graduate of the University of Paris of the Ecole Superieure d'Aeronautique et de Construction Mecanique. He has taught at Indiana University and at Columbia. During the war he was in charge of the mathematical work of the instrument section of the U. S. Ordnance. Dr. Pfeiffer received the degree of Mechanical Engineer from the Stevens Institute of Technology and the degree of Doctor of Philosophy from Columbia University. He has taught mathematics at Harvard, Princeton and Columbia. He is an associate editor of the Annals of Mathematics. Dr. Ritt took the degree of Ph.D. at Columbia University. He was for three years at the Naval Observatory and has since taught mathematics at Columbia. During the war he was one of the chief ballisticians in the U. S. Ordnance.

Belden Manufacturing Co., Chicago, is erecting a new four-story building to be designated building No. 8. This building will correspond to the present structures in that it will be of absolute fireproof construction, no wood whatever being used. Each floor contains about 10,000 sq. ft. of clear space. The first floor is to be used for a shipping, receiving and stock room until the permanent structure to house these departments is built. The second floor will be devoted to the excess needs of several of the departments. The third floor will be used entirely for the manufacture of textile magnet wire, while the fourth floor will be given over to the manufacture of "Beldenamel" magnet wire, being so designed that the entire process can be conducted on one floor. A spur track from the belt line railway adjoining the tract of land will be built facing these buildings on the street side, but even with the second story. This will permit loading and unloading by a special conveying system designed to eliminate so far as possible handling of goods. The space in the present factory building now occupied by the magnet wire and enameled wire departments will be used for expansion of the rubber-covered wire and cord departments, which have grown rapidly in the past few years.

New Buildings of Belden Manufacturing Co.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Lynn, Mass.—Davis Storage Battery Manufacturing Co., Chestnut street, is considering plans for the erection of a new addition to its plant. The structure is estimated to cost about $150,000.

Providence, R. I.—Ground has recently been broken by the Atlantic Mills, Equitable building, Boston, Mass., for the construction of a new three-story turbine building at its local plant on Manton avenue. The structure will be about 46x98 ft., and is estimated to cost $20,000. O. D. Purington & Co., Industrial Trust building, Providence, is the contractor.

Brooklyn, N. Y.—Plans have been filed by the R. H. Comey Co., 73 19th street, for alterations and improvements in the boiler plant at its works, to facilitate operations. Contract for the work has been awarded to Gibbons & Co., 316 Columbus street, Brooklyn.

Mt. Morris, N. Y. — Mt. Morris Illuminating Co. is making rapid progress in the construction of a power plant on the north side of the Genesee river, and it is expected that the work will be completed at an early date.

Newburgh, N. Y.—Alberger Pump & Condenser Co., 140 Cedar street, New York, has awarded a contract to the J. W. Cowper Co., Fidelity building, Buffalo, for the construction of a new addition to its local plant, to provide for increased capacity.

New York, N. Y.—Following the approval of a bond issue for $30,000,000 for various city improvements, the Board of Estimate has arranged plans for the construction of a new power plant and boiler house at the institution to cost about $200,000.

New York, N. Y.—In connection with the construction of a large new six-story cold storage plant at 780 First avenue, by the United Dressed Beef Co., considerable electrical equipment and refrigerating apparatus will be required. The structure is estimated to cost $250,000.

New York, N. Y.—Third Avenue Railway Co., 2396 Third avenue, has had plans prepared for improvements and alterations in its one-story shop building at 251 East 133rd street, to facilitate operations. Estimated cost about $6000.

New York, N. Y.—Lion Electrical Appliance Co., Inc., has filed notice with the Secretary of State of an increase in its capital from $25,000 to $100,000, to provide for general business expansion.

New York, N. Y.—Electric Bond & Share Co., 71 Broadway, has recently broken ground for the construction of a one-story extension to its power oil plant at Third and Kelley streets, Wichita, Kans., about 48x100 ft., to provide for increased operations.

New York, N. Y.—Announcement has been made that negotiations have been completed by the New York Edison Co. for the acquirement of the East Broad-Top Railroad, together with the coal mines and lands formerly owned by the Rockhill Iron & Coal Co. The entire property, which was secured for a consideration of about $5,250,000, is located in Huntingdon and Bedford counties and was purchased in order that the lack of coal should not interfere with the operation of the various plants of the company.

New York, N. Y.—Contract has recently been awarded to the New York Edison Co. for electric service for the operation of the new studio and laboratory building of the Fox Film Corp., 10th avenue and 55th street. Included in the structure are 12 complete theaters with entire electrical accessories, a large room in which a hundred sets may be erected and twenty companies work at one time, restaurant, executive and business offices, gymnasium, fire department, etc., requiring four service lines from the street to carry current for light and power, comprising two lines of 5000 amperes capacity and one of 4000 amperes for lighting, the fourth being a power connection of 400 kw. The total requirements aggregate 2800 hp. available 24 hours daily.

Oswego, N. Y. — Peoples Gas & Electric Co. has filed notice with the Public Service Commission of an increase in its capitalization from $1,000,000 to $1,300,000, to provide for general business expansion.

Watertown, N. Y.—Northern New York Utilities Co., 56 Public Square, has awarded final contracts for the construction of the proposed power plant and dam, with canal development on the Black River, Watertown. The project is estimated to cost about $250,000. The Walsh Construction Co., Watertown, is the contractor for the erection of the power plant, while Burns Brothers & Haley, Bank building, will be in charge of dam and canal work.

Bordentown, N. J. — Fire recently destroyed the engine plant and a portion of the works of the Independent Brick Co. Plant No. 2, near Fieldsboro, with total loss estimated at about $10,000. It is understood that the company is considering plans for rebuilding.

Camden, N. J.—Fire recently destroyed considerable rolling stock and a portion of the terminal of the Public Service Railway Co., Newton avenue, near Haddon avenue, with total loss estimated in excess of $250,000.

Gloucester City, N. J.—City Council is arranging plans for the installation of a large quantity of new equipment at the municipal water works, to increase the present capacity, an appropriation of $45,000 recently having been approved, to cover the cost of the work. It is understood that a like sum will be expended at a later date on further improvements at the plant.

Harrison, N. J.—Driver-Harris Co., Middlesex street, manufacturer of electric wires, cables, etc., is having plans prepared for the construction of a new three-story reinforced concrete addition to its plant, about 50x100 ft. The structure is estimated to cost $50,000.

Irvington, N. J. — In connection with the construction of a new two-story plant at 167-77 Coit street, by the Yocum Chemical Co., plans have been arranged for the erection of a boiler plant for general factory operation.

Newark, N. J.—Luthy Storage Battery Co., 420 Ogden street, has filed notice with the Secretary of State of an increase in its capital from $700,000 to $750,000 to provide for proposed expansion. The company has had plans prepared for the erection of a new extension to its plant.

Newark, N. J.—Washington Electrical Supply Co., 219 Washington street, has filed notice of organization to deal in electrical supplies. C. Katz, 115 16th avenue, heads the company.

Newark, N. J.—United Electrical Specialty Co. has filed notice of organization to operate at 207 Market street for the production of electrical supplies. William J. Bowen, 2 Broad street, heads the company.

Newark, N. J.—Plans have been completed by Stengel & Rothschild, Main street, for alterations and improvements in the boiler plant at their works, to facilitate operations. Estimated cost, $12,000.

Trenton, N. J. — City Commission has approved plans for the installation of new pumping machinery and equipment at the city water works plant, estimated to cost about $150,000. E. E. Brownell, Philadelphia, Pa., is consulting engineer for the commission.

Trenton, N. J.—Trenton Electric & Conduit Co., Tyler street, is planning for the construction of a two-story addition to its plant to cost about $10,000.

Trenton, N. J.—City Commission

is considering plans for the installation of a new ornamental arc lighting system along Sanhican Creek, from Calhoun street to the Log Basin, being an extension to the local park electric lighting system. Commissioner George W. Page will be in charge of the work.

Aspinwall, Pa.—Mackintosh-Hemphill Co., Pittsburgh, Pa., manufacturer of electrical appliances, has recently completed negotiations for the purchase of property at Aspinwall comprising about 26 acres, as a site for the construction of a new plant.

Cheswick, Pa.—The contracts for the new power plant of the Duquesne Light Co. have been awarded to Dwight P. Robinson & Co. Address A. W. Thompson, president of the company.

Dinsmore, Pa. — Breensburgh & Connellsville Coal & Coke Co. is having plans prepared for the erection of a new one-story power plant and coal tipple at its properties, to cost about $100,000. Baton & Elliott, National Bank building, Pittsburgh, are mining engineers for the company.

Grove City, Pa.—City is having preliminary plans prepared for the construction of a new addition to the municipal electric light plant to provide for increased operations. The structure is estimated to cost about $50,000. Sidney B. Martin, Penn building, Pittsburgh, is engineer.

Harrisburg, Pa. — Bethlehem Steel Co. has ordered a 5000-hp. electric plant built for its blooming mills at the Steelton plant.

Harrisburg, Pa.—Notice has been filed with the Public Service Commission by the Penn Central Light & Power Co. and the Northern Cambria Light, Heat & Power Co. of the addition of a coal clause to the schedules of rates for service.

Hershey, Pa. — Announcement has been made by the Hershey Chocolate Co. that plans are being arranged for the complete electrification of the company's private railroad, in connection with other extensive improvements and additions, estimated to cost in excess of $5,000,000.

Lewiston, Pa.—Considerable electrical and mechanical equipment will be required by the City Council in connection with the construction of the proposed disposal plant to cost about $60,000.

Philadelphia, Pa.—Connery & Co., Inc., Second and Luzerne streets, manufacturer of boilers, etc., has arranged for the construction of a new one-story brick addition to its assembling shop, about 75x90 ft.

Philadelphia, Pa.—Board of Managers of the Lankenau Hospital, Corinthian and Girard avenues, has awarded a contract to the A. Raymond Raff Construction Co., 1635 West Thompson street, for the construction of a new one-story brick transformer building at the institution.

Pittsburgh, Pa.—Fire recently damaged the plant of the Miller-Owen Electric Co., Lexington avenue and Thomas boulevard, to the extent of approximately $50,000. A quantity of electrical machinery, including dynamos and motors, was destroyed by the fire.

DATES AHEAD.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 26-28. Headquarters, Hotel Ottawa. Secretary - treasurer, Herbert Silvester, Monroe, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 3-6. Secretary, H. M. Stine, 211 Locust street, Harrisburg.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Pittsburgh, Pa.—Negotiations have been completed by the Westinghouse Home Co. for the acquirement from the Westinghouse Airbrake Co., nine tracts of land in Wilmerding, including a number of new brick dwellings, for a consideration of about $1,000,000. It is understood that the property will be utilized by the company for the construction of new dwellings for the service of employes connected with the Westinghouse interests.

Waynesboro, Pa.—City Council is considering plans for the construction of a new electric light plant for municipal service.

Baltimore, Md.—In connection with the proposed waterfront improvements planned by prominent local interests, estimated to cost in excess of $5,000,000, arrangements have been made for the construction of a new power plant to cost in the neighborhood of about $86,000.

Seat Pleasant, Md.—Plans are under consideration by the City Council for the construction of a new electric light plant for municipal service.

Warren, Md. — Warren Manufacturing Co. has had plans prepared for the installation of new power and boiler equipment to cost about $35,000 in connection with the proposed additions and improvements to its plant, estimated to cost about $250,000.

Wheeling, W. Va. — Gee Electric Co. is installing the electrical work for a big coal-stripping operation about to be started by the R. L. Culbertson Coal Co. near Cadiz, Ohio. The electrical work represents one of the largest electrical installation contracts of its kind in this section of the country. It includes motors aggregating 150 hp., electrically operated apparatus for cleaning coal and a complete lighting system for night operations.

Charleston, S. C.—Bureau of Yards and Docks, Navy Department, is considering plans for the installation of new mechanical stoker equipment and turbogenerator at the local Government station. The work is estimated to cost about $50,000.

Summerville, S. C. — Summerville Public Service Co., recently incorporated with a capital of $25,000, has acquired the local electric light and ice plant, and is understood to be considering improvements and alterations for increased service. M. Barshay is president.

Columbus, Ga. — Georgia-Alabama Power Co. is planning for the inauguration of activities on the proposed water power development near Albany, Ga., to include the construction of power plant, dam, and transmission system at Porter Shoals on the Flint river, near Albany. It is proposed to have a capacity of 15,000 hp. The project is estimated to cost in excess of $1,000,000. Baxter Shemwell, Lexington, N. C., is president of the company.

Locust Grove, Ga.—Plans are under consideration by A. R. Scott, McDonough, La., for the establishment of a local electric plant for supplying electric energy to Locust Grove and Stockbridge.

Springfield, Ga.—Citizens in mass meeting requested city officials to order election upon issuance of $10,000 of bonds for establishing light system. And building water works system.. Address mayor.

NORTH CENTRAL STATES.

Cleveland, Ohio. — Martin Bariss Co. will erect a $100,000 sawmill and power house. The specifications include electrical equipment. Architect George S. Reder, Century building, has prepared plans.

Anderson, Ind. — Anderson Foundry & Machine Co. has announced that it will enlarge its capacity with additional buildings and equipment to cost $100,000.

Connersville, Ind.—Teetor-Hartley Motor Corp., owned principally by Connersville capital, but located in Hagerstown, Ind., will soon begin the erection of a steel and concrete building, 100x1500 ft. The Ansted Engineering Co. will build a similar structure 100x400 ft. The Lexington Motor Co., to which the Ansted Engineering Co. is largely accessory, will build a new stockroom and expand its heating system.

Fort Wayne, Ind. — General Electric Co. has made two large purchases of ground within the last two weeks. One purchase was for $24,000 and the other was for $40,000. The sites acquired will be used for future extensions of the Fort Wayne plant.

Indianapolis, Ind. — Irvin Robbins

Co. will build a two-story brick and steel building, 60x400 ft., to cost $100,000.

Muncie, Ind.—Indiana General Service Co., according to a ruling of the Indiana Public Service Commission, must furnish electricity to the Muncie public library and other public buildings at a rate 25% lower than that charged consumers. The lower rate is provided for in the surrendered franchise of the company.

Chicago, Ill.—Wilson-Jones Loose Leaf Co. has purchased a site for erecting a modern factory estimated at $400,000. The specifications include a power house. Address general manager, 3021 Carroll avenue.

Deer Creek, Ill.—A company has been formed here to supply light and power to Deer Creek, Cruger and adjacent territory. J. A. Danforth is the president and F. L. Belsley, secretary-treasurer. Power will be furnished by the Peoria Light & Power Co., this company to put in a reducing station at Cruger at which point the new organization will attach on their lines. The new company has been capitalized at $25,000.

Dundee, Ill. — Packard Electric Co. will open one of its branch stores in Dundee, Sept. 1.

Elgin, Ill.—Plans and specifications for the new municipal light and power plant, for which a bond issue, is soon to be voted by the people, are being prepared in the Elgin city hall. The new plant will cost approximately $200,000.

Knoxville, Ill.—F. M. Willard and Leo Allen have formed the Knoxville Electric Co. to deal in general electrical merchandise and will make a specialty of overhauling motors and generators.

Monmouth, Ill.—Altenberg Tire & Equipment Co. will remove its factory from Davenport, Iowa, to this city. The company plans the erection of a four-story building to cost $100,000.

Ottawa, Ill. — Wilson & Co. have secured the contract for wiring the new high school at Marseilles for $496.

Peoria, Ill.—A new $500,000 factory will be erected by the Western Structural & Machine Works, recently incorporated.

Peru, Ill. — Peru Construction Co. has been awarded the contract to build an addition to the building now occupied by the Western Clock Co., the addition to have 33,000 ft. of floor space.

South Pekin, Ill. — The village board will advertise for bids for a lighting system, and will award a franchise to the most favorable bidder. Louis O. Dunkelberg, village attorney.

Vassar, Mich.—The council is planing ways and means to improve the light and water system. Address village clerk.

Montevideo, Minn. — The Sioux Falls-Pipestone electric transmission line has been practically completed as far as Dell Rapids and it is estimated that the line will be completed to serve Pipestone by the middle of October.

St. Paul, Minn.—Northern States Power Co. is now supplying the electrical energy requirements of the new St. Paul Athletic Club, amounting to about 287 hp. in motors.

Chetek, Wis.—Election will be held soon to submit to voters proposal to purchase distribution system of Chetek Light & Power Co.

Port Washington, Wis.—Plans are being made by Douglas Cahill, engineer, Gross building, Milwaukee, for an additional municipal power house. The plant will be 20x40 ft. and will cost about $30,000.

Waupaca, Wis. — Stock Co. will soon let contracts for a hydroelectric power plant. Address F. H. Josslyn, general manager, Algoma building, Oshkosh, Wis.

Hastings, Mich.—It is said that the General Motors Corp. has purchased the plant of the Hastings Consolidated Press & Tool Co. for $1,000,000 and that the capacity of the plant will be quadrupled to employ 1200 men.

Burlington, Iowa.—A special election will be held to vote on the question of issuing $30,000 bonds for municipal electric light plant. Address E. P. Weinstein, clerk.

Davenport, Iowa. — Tri-City Railway & Light Co. has been granted permission to install a transmission power plant from Brady street road at city limits, of Davenport to Five Mile house.

Monticello, Iowa. — Monticello Electric Co. is making improvements at its power plant which will cost $20,000. The new equipment will include two 112-kv-a. vertical type generators and also two vertical turbine water wheels. These two turbine water wheels will develop over 80% more power than that obtained from the wheels now in use.

St. Joseph, Mo.—St. Joseph Railway, Light, Heat & Power Co. will expend $1,000,000 in improvements and extensions. Address general manager.

Auburn, Neb.—Citizens have petitioned the city council asking for permission to hold a special bond election to extend the facilities of the municipal light plant so that it can enter into the business of furnishing commercial light and power.

Lincoln, Neb. — Plans now under consideration to install a power plant at the University of Nebraska Medical College to cost $60,000. Address Samuel Avery, president.

Minden, Neb.—$35,000 bonds have been voted to be used in the extension and improvement of the city light plant. Address city clerk.

Gregory, S. D.—At a special election $122,000 bonds for improvements to municipal electric light, waterworks, and sewer system bonds were carried.

SOUTH CENTRAL STATES.

Owensboro, Ky. — Kentucky Electric Lamp Co. has had plans prepared for the construction of a new three-story brick and concrete plant, about 60x100 ft., to provide for increased capacity. It is proposed to increase the output from about 3000 to 8850 lamps daily.

Birmingham, Ala. — Alabama Port Co., which has purchased property of Selma Lighting Co., will construct power lines between this city on the Coosa River, a distance of 57 miles.

Hobart, Okla.—$135,000 in bonds have been voted for an electric light plant. V. V. Long & Co., engineers, 1300 Colcord building, have prepared plans.

Perry, Okla.—City Council is considering plans for the issuance of bonds for $260,000, to cover the cost of improvements and extensions in the municipal electric light and water systems.

Tishomingo, Okla. — Engineers Johnson & Benham, Firestone building, Kansas City, will prepare plans for a light and water plant. F. L. Yarger, city clerk.

Dallas, Tex.—Dallas Hotel Co. will expend $20,000 enlarging the power plant of the Adolph Hotel. Address George W. Wells, supervising engineer, 4308 Washington boulevard, St. Louis, Mo.

WESTERN STATES.

Libby, Mont.—Tukens-Hazel Mining Co. is considering the construction of a power plant and 200-ton concentrator at its property 9 miles from here. Estimated cost, $200,000 and $240,000 concentrator.

Colorado Springs, Colo. — The Spruce street car line will be erected. The extension on the Spruce line calls for about 4 miles of trackage, to cost about $150,000. The whole proposition is only tentative at present and the outcome depends entirely upon the reports submitted by the engineers and surveyors. Should the line be extended on to the Stark-Corley lines, it would represent a large outlay of cash, as the road would have to cross several ravines, necessitating the building of a number of bridges. Address A. E. Carlton, president of the Pikes Peak Fuel Co.

Pueblo, Colo.—The city of LaJunta has decided to discontinue operation of its steam plant for pumping the city water supply and has contracted with the Arkansas Valley Railway, Light & Power Co. for electrical energy for this purpose.

Manti, Utah—City has authorized a bond issue of $20,000, the proceeds to be used to cover the cost of the construction of a new municipal electric light and power plant.

Kelso, Wash.—North Coast Power Co. has recently awarded a contract to N. A. Strand, Kelso, for the construction of a new brick substation near its office building. The company has also recently commenced the rebuilding of its power line from Kelso to Kalama, increasing the carrying capacity to 66,000 volts. The total cost of the work is estimated at about $40,000.

Seattle, Wash.—City Council has passed bill favoring extension and authorizing issuance and sale of

$1,350,000 light and power utility bonds to cover the cost of steam plant on Lake Union, adjoining present plant.

Tacoma, Wash. — City officials, in support of a proposed bond issue of $300,000 to purchase Lake Cushman power site on Skokomish river, state that the business of the municipal power plant has doubled in the last two years, and that the rate of increase is now about 33% annually. The Lake Cushman development, as outlined, will require an expenditure of about $6,500,000.

Tacoma, Wash. — Provided voters authorize bonds for the Lake Cushman power project, the city in constructing the 45-mile transmission line will erect a record breaking overhead span across the Narrows.

Bend, Ore.—T. H. Foley, manager of the local interests of the Bend Water, Light & Power Co., announces that the construction of a 1000-kw. steam plant to cost $100,000 will be started here within the next two weeks. It is expected the new plant which will double the power output of the power house here, will be completed by February, 1920. Plans for construction of a $125,000 plant on Tumble creek, work on which was to have started the latter part of the summer, will be halted until next summer.

Dallas, Ore. — Recent additions to the electrical energy load of the Dallas division of Mountain States Power Co. include an additional 25 hp. in motors for the Central Tile Co., and an addition at the gravel plant at Independence, making the Gravel plant's requirements 205 hp.

Klamath Falls, Ore.—California-Oregon Power Co., which has in progress the construction of a dam on Link river for water-power purposes, is defendant in a suit in the Federal court brought by the land owners who live near Upper Klamath lake. The plaintiffs seek to have the company enjoined from completing the dam, contending that the dam will raise the water in the lake to a height that will cause serious overflow of farm land. The company, however, claims it is only preparing to hold the water at flood level.

Portland, Ore.—The estimated expense of building an electric railroad from the St. Johns municipal terminal connecting with the Portland Railway Light & Power line and St. Johns is $30,000, according to figures compiled by Engineer Hegardt of public dock commission.

Roseburg, Ore.—William Polman, Baker, Ore., operating the local electric light and water plant, is arranging plans for extensive improvements to facilitate operations. It is also proposed to make improvements and alterations in the pumping and power plant on the North Umpqua river.

Avalon, Cal.—An election will soon be held to vote on an $88,000 bond issue for light and water plant construction.

Chico, Cal.—A surveying party will enter Chico canyon to make surveys of proposed site for a municipal power plant. Address F. S. Robinson, city engineer.

Fresno, Cal.—The Board of Supervisors of the county of Fresno of the Raisin City Lighting District of Fresno county invites and advertises for bids for furnishing, installing, maintaining and keeping in repair all necessary apparatus and caring for and maintaining the lights for Raisin City lighting district of Fresno county and for supplying district with electricity for operating and maintaining lights to be installed within district for a term of 5 years. Address D. M. Barnwell, clerk of board.

Los Angeles, Cal.—Contract has recently been awarded to H. H. Walker, Marsh-Strong building, for the installation of electric wiring, etc., in the new hotel building to be erected by the Wilshire Boulevard Hotel Co. on Wilshire boulevard, at cost of $27,612.

Los Angeles, Cal.—Pacific Electric Railway Co. has completed plans for the erection of a power plant at Los Angeles harbor. The structure is estimated to cost about $12,000.

Mayfield, Cal.—Town council is considering plans for the issuance of bonds for $20,000, to provide for the installation of a new electrical distributing system and $5000 for a new pump and motor equipment at the municipal water works.

Orange, Cal. — City trustees are having plans prepared for the installation of a new electric street-lighting system, ornamental type, on Glasswell street and Chapman avenue. About 157 standards will be required.

Oroville, Cal.—The Great Western Power Co. has awarded a contract to the Stone & Webster Co., Boston, for the construction of the proposed power plant at Caribou, near Belden.

Palo Alto, Cal.—City has authorized the issuance of bonds for $75,000, the proceeds to be used to cover the cost of the installation of a Diesel engine and generating unit at the municipal power plant. It is expected that the proposed work will be completed within 90 days.

Reedley, Cal.—Town Council recently awarded a contract to the Reedley Electrical Works for the installation of an electrolier system at $11,800.

San Diego, Cal.—San Diego Consolidated Gas & Electric Co. is making a short extension of its transmission line to furnish power to the city of San Diego for constructing a new $750,000 dam at Barrett, which will increase the city's water supply.

Whittier, Cal.—Southern California Edison Co. has had plans prepared for the construction of a one-story brick office and garage building, about 100x100 ft.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (29,796). — The agency and purchase of novelties, hardware, food products, oleomargarine, lard presses, electrical goods, general merchandise, canning machinery and machinery to make tin cans are desired by a firm in Australia. References.

Electrical Implements (30,190).—A business man in France wishes to secure the representation of exporters of agricultural implements, machines, automobiles, electrical implements, and, in general, all industrial material. Correspondence should be in French.

Pumps (30,192).—The purchase of pumps of all sorts and pump machinery, such as a full line of turbine, centrifugal, and steam pumps, is desired by a firm in Spain. Quotations should be given c. i. f. Spanish city. Correspondence may be in English. References.

Electrical Goods (30,175).—A firm in Brazil desires to secure the representation of American steamship companies, and agencies for the sale of sugar mill machinery and supplies, glassware, paper, arms and ammunition, furniture, hardware, cement, line, drugs, electrical goods, paints, dyes, automobile tires, motorcycles and automobiles. Correspondence may be in English. Reference.

PROPOSALS

Cranes, Motors, Etc.—Bids will be received until 10:30 a. m., Sept. 2, by A. L. Flint, general purchasing agent, Panama Canal, Washington, D. C., for cargo handling cranes, air compressors, electric motor and spare parts, starting panels, motor-driven triplex pump, Hamilton-Corliss engine, fiber conduit bends, etc.

Motors—Bids will be received Sept. 3, at Room 406 City Hall, Chicago, for constructing and delivering f. o. b., two wound rotor induction motors with necessary starting apparatus, and other electrical equipment for the Chicago avenue pumping station, according to specifications on file in the office of Room 406, City Hall. Address Charles R. Francis, commissioner of public works.

Switchboards and Generator Equipment.—Until Sept. 4, bids will be received by J. H. McAlpin, mayor of Hollandale, Miss., for the installation of new switchboard and generator equipment at the municipal electric light plant, and for the furnishing of new street-lighting fixtures. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

Electrical Material.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for 79 branch, composition boxes; 10,000 incandescent socket bushings; a miscellaneous quantity of midget push buttons; 50 lb. pressed plate, flexible, Grade A mica; 400 hard rubber, telephone transmitter mouthpieces, and 50 non-water-tight telephone plugs to be delivered at South Brooklyn, N. Y. (Schedule 4241), and 3000 mogul lamp sockets,

for delivery at Portsmouth, N. H. (Schedule 4269).

Motor-Driven Pump.—The town of Leland, Miss., will receive until Sept. 2 bids for the boring of a 10-in. well, to be about 500 ft. deep with top, to be 16-in., to depth of about 100 ft. Well to be equipped with electric motor-driven pump and necessary machinery to deliver 600 gal. of water per minute. All bids must be accompanied by New York Exchange or cashiers' check for $500, and be in the hands of J. H. O'Quinn, town clerk, on or before 6 p. m., Sept. 2.

NEW PUBLICATIONS

"New Forms of Instruments for Showing the Presence and Amount of Combustible Gas in the Air" is the title of Scientific Paper 334, published by the Bureau of Standards, Department of Commerce. This paper contains a description of experimental work upon the combustion of gas at the surface of an electrically heated wire and the application of this phenomenon to the design of instruments for detecting the presence or indicating the amount of combustible gas in the air. The copy is now ready for distribution and those interested may obtain a copy by addressing a request to the Bureau of Standards, Department of Commerce, Washington, D. C.

INCORPORATIONS

New York, N. Y.—Monroe Electric Supply Co., Inc. Capital, $10,000. To manufacture electrical supplies. S. and J. Weiner, and J. A. Herman, 996 Home street, are the incorporators.

Buffalo, N. Y.—Mighty Manufacturing Co., Inc. Capital, $50,000. To manufacture electrical and mechanical devices. Incorporators: George N. Chaltas, E. Pappas, and E. L. Crabb, Buffalo.

Newark, N. J.—Amann & Finn. Inc. Capital, $50,000. To manufacture motors, etc. C. and E. F. Amann, Irvington, and D. J. Finn, New York, are the incorporators.

Harrison, N. J.—Gilby Wire & Dye Co. Capital, $125,000. To manufacture electrical wires, etc. Incorporators: Walter and Stanley Gilby, and T. W. Pell, Harrison.

New York, N. Y.—Humil Corp. Capital, $300,000. To manufacture electrical apparatus, etc. Incorporators: J. Van Harder, H. H. Thurlow, and F. D. Hagan, 55 Liberty street.

Hartford, Conn.—Perry Electric Co. Capital, $20,000. To operate a general electrical engineering and contracting establishment. Incorporators: E. C., G. W., and S. J. Perry, Hartford.

Philadelphia, Pa.—American Electric Storage Battery Co. Incorporated under Delaware laws with a capital of $1,000,000. To manufacture electric storage batteries. E. M. MacFarland, F. R. Hansell, Philadelphia; and J. V. Pimm, Camden, N. J., are the incorporators.

Burnsville, N. C.—Burnsville Electric Co. Capital, $15,000. To operate a local electric light and power plant. William C. Skaggs is the principal incorporator.

Greenville, S. C.—Piedmont Electric Co. Capital, $10,000. To manufacture electrical goods. R. E. Starnes is the principal incorporator.

Elkhart, Ind.—Mann Electric Co. has been incorporated with capital of $10,000, to engage in a general electrical contracting business. The incorporators are Vernon V. Mann, Fred Lemon and S. W. Long.

Walla Walla, Wash.—Lewiston and Walla Walla men have incorporated the Electric Equipment Co. The company will do a general business in electric light equipment. The incorporators are J. G. Harlan, C. O. Hawkinson and others.

West Point, N. D.—Bentinck Telephone Co. has incorporated with a capital of $1500. Address John Kuich.

Sioux Falls, S. D.—Electrical Brokerage Co. has incorporated with a capital of $100,000. It will manufacture, buy and sell and generally deal in electrical machinery and equipment and install electric light plants. The incorporators are W. L. Patterson, O. Shakstad, and E. S. Requa, of Sioux Falls.

Ivor, Va.—Ivor Light & Power Co. has incorporated with a capital of $5000. T. A. Saunders is president; L. C. Pulley, secretary and treasurer; H. M. Rawls, engineer.

Coon Valley, Wis.—Coon Valley Electric Co. has incorporated with a capital of $10,000. Incorporators are Anton Clum, Lizzie Bekkum and others.

Greenville, Ala.—Electric & Manufacturing Co. has incorporated with a capital of $50,000, to manufacture electrical specialties, etc. R. A. Beeland is the principal incorporator.

Dover, Del.—S. N. Blake & Co., Inc., has incorporated with a capital stock of $100,000, to operate various public utility companies, etc. Incorporators: Frank Jackson, W. I. N. Lofland, and C. L. Harmonson.

Dover, Del.—Dannenhauer, Inc., with a capital of $100,000, to manufacture electrical appliances, etc. Incorporators: W. A. Dannenhauer, G. H. Speakman, Wilmington; and J. J. Justice, Newport, Del.

Belleview, Fla.—Belleview Utilities Co. has incorporated with a capital of $25,000. Water works extension will be made, including galvanized iron pipes, wood frames, to cost $2500, to supply 23 families; electric double acting pump, 5000-gal. pressure system will be installed. Address Edw. S. Stench, secretary.

Champaign, Ill.—The Champaign Hotel Co. has been incorporated with a capital of $250,000 to erect reinforced concrete and steel hotel, to contain 156 rooms, specifications include special lighting plant.

Port Byron, Ill.—The Coe Light & Power Co. was incorporated with a capital of $10,000. It will furnish electric light and power in this village. Incorporators: S. L. Woodburn, Wm. Saddoris, and others.

Charlottesville, Ind.—Charlottesville Electric Light, Heat & Power Co. has been incorporated with capital of $5000. Address W. S. Lane, Charlottesville, Ind.

Berwick, Kan.—The Berwick Transmission Line Co. has been chartered with $25,000 capital by Nathias Strahm, E. T. Ukele and Norman Fike.

New York, N. Y.—Liberty Appliance Corp. has incorporated with a capital of $15,000, to manufacture electric and gas fixtures, etc. Incorporators: L. M. Rosenthal, J. Hohenstein, and Edward Meyer, St. Louis, Mo.

Mount Jewett, Pa.—Mount Jewett Electric Co. has incorporated with a capital of $25,000, to operate a local electric plant. W. H. Brown, Ridgway, is the principal incorporator.

Mount Pocono, Pa.—Mount Pocono Electric & Improvement Co. has incorporated with a capital of $20,000, to operate a local electric light and power system. W. J. Schaffer is the principal incorporator.

Portsmouth, Va.—Miller Bros. Electrical Co. has incorporated with E. R. Bardsdale president, and H. G. Walker, secretary.

Charlestown, W. Va.—Charlestown Heat & Light Co. has incorporated with a capital of $50,000. Incorporators: Jay Gates and others.

Syracuse, N. Y.—Hughes Electrical Construction Co. Capital, $25,000. To engage in electrical contracting. Incorporators: L. V., F. D., and J. J. Hughes.

New York, N. Y.—International Incandescent Lamp Works. Capital, $25,000. To manufacture electric lamps. Incorporators: I. Goldberg, C. Schickerling and C. F. Lyngass, Great Kills, S. I.

Somerville, Mass.—American Electric Co. Capital, $25,000. To manufacture electrical equipment. Incorporators: Joseph V. Pierce, Jay T. Cook and Almon W. Preble.

Chicago, Ill.—Wheeler Battery Co. Incorporated in Delaware with capital of $2,000,000. To engage in manufacturing, electrical engineering and contracting. Incorporators: Samuel C. Wood and Arthur M. Brody, Chicago.

Mount Oliver, Pa.—Walsh Storage Battery Co. has incorporated with a capital of $5000 to manufacture storage batteries. Morris Walsh, Knoxville, is the principal incorporator.

Summerville, S. C.—Summerville Public Service Co. has incorporated with a capital of $25,000. J. A. Guerin is one of the principal incorporators.

Hayesville, Ga.—Public Service Co. has incorporated with a capital of $125,000. Incorporators: G. H. Hairler and others.

Personals

Richard L. Wildauer Appointed Central District Manager Arrow Electric—J. A. Massie Retires—Other Changes

P. A. ERLACH has been named secretary of the Central Illinois Public Service Co., with headquarters at Springfield, Ill. Mr. Erlach has been serving as auditor for several years.

J. D. WHITTEMORE, general manager of the West Virginia Traction & Electric Co., Wheeling, W. Va., has recently been appointed receiver for the company by Judge Dayton, of the United States District Court.

GUY S. HAMILTON, advertising manager of the American Steam Conveyor Corporation, Chicago, has been appointed editor of the *Booster*, the corporation's newly established sales organ.

H. S. VALENTINE, for more than five years connected with the Link-Belt Co., has accepted the appointment of sales engineer in charge of Philadelphia territory for the American Steam Conveyor Corp.

R. A. CREWS, of Charleston, Ill., has been named auditor of the Central Illinois Public Service Co., with headquarters at Mattoon, Ill. He will succeed P. A. Erlach, who has been named secretary.

THOMAS O. MORGAN, until recently head of the service department of the New York office of the American Steam Conveyor Corp., has been promoted to the position of sales engineer and will handle Long Island and Connecticut territory.

H. R. WICKERSHAM, Allentown, Pa., manager of the local branch of the electrical contracting firm of the Macan Jr. Co., recently tendered an interesting address on the development of the uses of electricity at the meeting of the Kiwanis Club at the Hotel Allen.

WILLIAM S. MURRAY, for many years chief electrical engineer of the New York, New Haven & Hartford Railroad and recently president of the Hoosatonic Power Co., which supplies power to some of the lines of the Connecticut company, has opened an office as consulting engineer in New York.

A. S. WITMER, formerly of the commercial department of the Louisville Gas & Electric Co., has been selected to head the million dollar Industrial Foundation. The Foundation under the leadership of Tampton Aubuchon has secured the location of 25 new factories in Louisville during the past two years.

W. P. NASER, manager of the Trumbull Electric Manufacturing Co., Chicago, has tendered his resignation to take effect in October, 1919. He has been connected with the Trumbull company for nearly seven years. He opened a branch for the company in San Francisco during the World's Fair and was later promoted to the larger Chicago branch. "Bill" Naser is well known in the Middle West, the South and on the Coast.

B. C. Condit, who served several years as construction engineer for the Northwestern Electric Co., Portland, Oregon, within which period the company's steam-electric plants were built, now occupies the position of consulting engineer for the same concern.

RICHARD L. WILDAUER, formerly assistant sales manager, Arrow Electric Co., Chicago, has been appointed manager of the central district for the Arrow company, succeeding E. M. Scribner. Mr. Wildauer has a wide acquaintance in the electrical field, especially in the Middle West, and his many friends unite in expressing gratification over his well deserved promotion. He has been connected with the Arrow Electric Co. in the Chicago territory for the past 10 years and previous to that was with the American Circular Loom Co., Chicago, for two years.

Richard L. Wildauer.

J. A. MASSIE, for several years sales manager for the Hoyt Electrical Instrument Works, Penacook, N. H., has retired from active service with the company and will take a long and well earned rest. He will, however, continue to be identified with the organization through his interest in the Burton-Rogers Co., which has been made the sales department of the Hoyt Electrical Instrument Works, M. T. Rogers taking over Mr. Massie's duties.

CHARLES S. RUFFNER, vice-president and general manager of the Union Electric Light & Power Co., St. Louis, has been elected a director and vice-president of the North American Co., New York, the controlling company of the St. Louis utility. Mr. Ruffner relinquished the local management of the St. Louis subsidiary when accepting the appointment with the parent company. He retains the offices, however, of vice-president of the Union Electric Light & Power Co. and the St. Louis County Gas Co. and president of the American Light & Power Co., St. Charles, Mo., the Commercial Telephone Co. and the Arrow Engineering Co., all of which are subsidiaries of the North American Co. Mr. Ruffner was born in Chicago in 1880 and was graduated from the University of Missouri in 1900 with the degree of Bachelor of Science in electrical engineering. He entered the engineering profession with the Telluride Power Co. and Central Colorado Power Co. doing large power transmission work, and since 1911 has been an officer of subsidiaries of the North American Co. He is a manager and fellow of the American Institute of Electrical Engineers and a member of the American Electrochemical Society. He was also appointed associate member of the Naval Consulting Board in 1916.

FREDERICK S. DELLENBAUGH, Columbia University, 1910, ARTHUR L. NELSON, Massachusetts Institute of Technology, 1915, and F. B. PHILBRICK, Massachusetts Institute of Technology, 1918, have been appointed instructors in electrical engineering at the Massachusetts Institute of Technology. Mr. Dellenbaugh was a captain of the Signal Corps in overseas service during the war. He was graduated from the electrical engineering course at Columbia, and has been in the employ of the Crocker-Wheeler Manufacturing Co. and the Westinghouse Electric & Manufacturing Co. in the departments of design and commercial engineering. His particular duties in his new appointment will be in the teaching of dynamo design and the mechanical applications of electric power. Mr. Dellenbaugh will also give a portion of his time to research along lines relating to electrical machinery. Mr. Nelson was graduated from the electrical engineering course of the Massachusetts Institute of Technology. During the war he was a lieutenant in the Engineer Corps of the Navy with important work relating to construction of power plants and supply of power at the submarine base. After graduating he had experience with the C. H. Tenney Co. in construction and operation of electric plants. Mr. Nelson's work will be instruction relating to central stations and distribution systems. He will also carry on some work as a consulting engineer. Mr. Philbrick since graduating has been in the employ of the General Electric Co. His work at the Institute will be instruction in electrical measurements under the direction of Professor Laws and carrying on researches relating to electric circuits which Professor Laws has on hand.

For the Readjustment Period—What?

XLIX.

ACTION!

"It can't be done!" has been a mental hazard for the timid ever since time began.

It rules any individual or business that supinely admits it.

But to the man or the business potent with the "I will" spirit, it is a dare which strengthens the determination to succeed.

We deliberate but never hesitate. Perhaps that is why we have converted the hazards of so many businesses into stepping-stones to success.

Henri, Hurst & McDonald, Inc.
Chicago

This statement by one of the leading advertising service agencies of the country sounds the keynote of success in industrial readjustment. It applies particularly to the manufacturer and his problems.

C. A. TUPPER ..... *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

Thrift Will Overcome High Prices.

R. H. Ballard, of Los Angeles, president of the National Electric Light Association, says:

"We have gone through a very strenuous war period, and had many claims to meet, but taking a broad view of things it is plain that our country as a whole is in good shape right now. The banking power of the United States is far greater now than ever in history; factories are operating at close to capacity in all lines; foreign countries are making a tremendous demand upon us for supplies and as soon as the public utility problem is fairly met—as it must be—the country will be in shape to go ahead at ever greater speed. Our savings per capita were $113 in 1918, as against $89 in 1914, and in addition to this our war savings were $9 per capita.

"That is just about equal to the average increase in living expenses due to high prices, and with a continuance of the spirit of thrift and saving, prices will gradually come down as we reduce the inflation in our money, which is largely the cause of high prices. We should continue in thrift and economy, avoiding extravagance and waste, and in this connection should remember that thrift includes the continuance of production and useful expenditure. If with Mr. Micawber we are 'waiting for something to turn up,' we are wasting time, and this is extravagant."

Byllesby Bond Department Expands.

In connection with the expansion of the securities and banking department of H. M. Byllesby & Co., and following the plans recently announced by which they have turned over to Standard Gas & Electric Co. the engineering and management part of their business, the following promotions as part of the foregoing plans are announced:

W. H. Clarke, formerly manager of the bond department, becomes a vice president of H. M. Byllesby & Co. in charge of the buying department and with special reference to syndicate participations. Joseph H. Briggs becomes manager of the bond and securities department, resident at Chicago, in charge of sales. Captain Albert S. Cummins becomes assistant manager of the bond and securities department, resident at Chicago. Lieutenant Chester C. Levis becomes manager of the New York City office of H. M. Byllesby & Co.

Northern California Power Company Would Sell Its Properties.

The Northern California Power Co. has applied to the railroad commission for authority to sell its properties to the Pacific Gas & Electric Co. for the sum of $3,400,000. The holdings include six hydroelectric generating plants in the counties of Shasta, Tehama, Trinity, Butte, Glenn and Colusa; gas generating plants and distributing system in Redding, Red Bluff and Willows; water plants and systems in Redding and Willows; and several water rights, reservoirs and canals.

The merger of these two companies will make possible early development of water power on the Pitt river, the application states. The Pacific Gas & Electric Co. owns the entire capital stock of the Mount Shasta Power Corp. and through that ownership, possesses water rights on this river which will produce 175,000 hp. of electric energy, it is estimated. The Northern California Power Co. estimates its production of electric energy in the same locality at 80,000 hp. As there are conflicting claims regarding these water rights, the companies believe that the merger will end long and costly litigation which would have been necessary to settle the priority of these rights.

West Baden & French Lick Water, Light, Heat & Power Co. has issued $200,000 of preferred stock, bringing the total capitalization up to $300,000. The company supplies water and electricity to the towns of West Baden and French Lick and to the numerous hotels centering at the famous resort.

U. S. Light Elects New Directors.

At the recent annual meeting of the U. S. Light & Heat Corp. stockholders elected John N. Willys and C. O. Miniger as new directors. At the organization meeting of the board, John N. Willys was named chairman, succeeding E. H. Gold, who was elected vice-chairman of the board, a new office. R. C. Caples was elected vice-president and other officers were re-elected.

Kansas Gas & Electric Increases Capital.

Stockholders of the Kansas Gas & Electric Co., which serves Wichita and other cities and communities principally in southeastern Kansas, have voted to increase the capital of the company to $12,000,000, including $6,000,000 7% preferred stock and $6,000,000 in common stock. The authorized capital prior to the action of the stockholders in voting an increase was $2,500,000 of cumulative preferred and $3,000,000 of common stock.

It is stated that the company probably will put out $1,500,000 of the additional preferred stock authorized before the end of the year. The company plans to obtain par and accrued dividends for this issue. It is also probable that the common stock outstanding will be increased.

The Kansas Gas & Electric Co. is making improvements and extensions which will probably involve an expenditure of $2,000,000 in the next two years. It had planned expenditures of $15,000,000, but this was checked by the refusal of the last session of the Kansas state legislature to grant the company an indeterminate permit to operate in the cities it serves. The Kansas law limits its franchise to 20 years, which acts as a restricting influence in long time financing. The company is serving cities and communities in Kansas with a population of more than 150,000.

Earnings.

PACIFIC POWER & LIGHT CO.

For 12 months to June 30—Gross, $1,975,710, increase $205,855; net after taxes, $910,573, increase $5190; total income $920,370, increase $14,987; balance after interest, etc., $381,688, decrease $66,417; surplus after preferred dividends, $192,688, decrease $74,234.

For June—Gross, $180,998, increase $26,257; net after taxes, $95,566, increase $16,684; total income, $96,189, increase $17,307; surplus after charges, $50,323, increase $12,959.

KANSAS GAS & ELECTRIC CO.

For 12 months to June 30—Gross, $2,407,806, increase $549,964; net after taxes, $755,254, increase $189,438; total income, $773,729, increase $207,913; balance after interest, etc., $324,424, increase $87,530; preferred dividends, $133,969, increase $969; surplus, $190,455, increase $86,561.

For June—Gross, $179,295, increase $28,743; net after taxes, $49,453, decrease $2500; total income, $49,474, decrease $3479; surplus after charges, $10,418, decrease $9900.

Dividends.

The General Electric Co. has declared a quarterly dividend of 2%, payable Oct. 15 to stockholders of record Sept. 15.

A quarterly dividend of 1¾% has been declared by the Philadelphia Electric Co., payable Sept. 15 to stock of record Aug. 20.

Fairbanks, Morse & Co. has declared a quarterly dividend of 1½% on preferred stock, payable Sept. 2 to stock of record Aug. 20.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Aug. 12.	Bid Aug. 19.
Adirondack Electric Power of Glens Falls, common	6	12	12
Adirondack Electric Power of Glens Falls, preferred	6	75	75
American Gas & Electric of New York, common	10+extra	125	122
American Gas & Electric of New York, preferred	6	41	41
American Light & Traction of New York, common	..	230	228
American Light & Traction of New York, preferred	6	96	95
American Power & Light of New York, common	4	63	60
American Power & Light of New York, preferred	6	73	69
American Public Utilities of Grand Rapids, common	..	10	10
American Public Utilities of Grand Rapids, preferred	7	30	30
American Telephone & Telegraph of New York	..	102¾	101
American Water Works & Elec. of New York, common	..	6	5½
American Water Works & Elec. of New York, partic.p.	7	10	10
American Water Works & Elec. of New York, first preferred	..	38	58
Appalachian Power, common	..	4	5
Appalachian Power, preferred	7	23	22
Cities Service of New York, common	+extra	436	434
Cities Service of New York, preferred	6	76¾	76¼
Commonwealth Edison of Chicago	8	107½	107
Comm. Power, Railway & Light of Jackson, common	..	25	25
Comm. Power, Railway & Light of Jackson, preferred	6	57	57
Federal Light & Traction of New York, common	..	10	10
Federal Light & Traction of New York, preferred	..	46	46
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	2+extra	30	30
Middle West Utilities of Chicago, preferred	6	53	53
Northern States Power of Chicago, common	..	65	65
Northern States Power of Chicago, preferred	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common	..	67	66¾
Pacific Gas & Electric of San Francisco, preferred	6	87½	88
Public Service of Northern Illinois, Chicago, common	7	87	86
Public Service of Northern Illinois, Chicago, preferred	6	94	94
Republic Railway & Light of Youngstown, common	4	15	15
Republic Railway & Light of Youngstown, preferred	6	52	50
Standard Gas & Electric of Chicago, common	..	29	31
Standard Gas & Electric of Chicago, preferred	6	44	45
Tennessee Railway, Light & Power of Chattanooga, common	..	5	5
Tennessee Railway, Light & Power of Chattanooga, preferred	6	19	15
United Light & Railways of Grand Rapids, common	4	45	45
United Light & Railways of Grand Rapids, preferred	6	72	72
Western Power of San Francisco, common	..	22½	24½
Western Union Telegraph of New York	extra	85	85½
Industries.			
Electric Storage of Philadelphia, common	4	86	83
General Electric of Schenectady	8	162¾	162¾
Westinghouse Electric & Mfg. of Pittsburgh, common	7	52⅝	52